ENGINEERING CHANGE NOTICE

Page 1 of 2

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ECN

2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void ☐		3. Originator's Name, Organization, MSIN, and Telephone No. MW Benecke, 19100, L6-26, 376-0002		4. USQ Required? ☐ Yes ☒ No		5. Date 11/09/99	
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13a. Description of Change - Redesignate document to HNF-SD-NR-ISB-001, Rev. 1. - Update classification for individual buildings, including the non-fuel storage buildings. - Reflect shutdown activities. - Update accident analysis to reflect revised fire probability, revised release and respirable fractions, and revised oxidation rate estimates. - Add controls to address potential toxicological risk. Independent design verification performed by informal FSS peer review.				13b. Design Baseline Document? ☒ Yes ☐ No			
14a. Justification (mark one) Criteria Change ☒ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const ☐ Const. Error/Omission ☐ Design Error/Omission ☐							
14b. Justification Details Update facility classification to reflect in-progress deactivation, and address non-fuel storage buildings. Describe controls to ensure that probability of unmitigated storage building fire is "extremely unlikely".							
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INTERIM SAFETY BASIS FOR FUEL SUPPLY SHUTDOWN FACILITY

Prepared for the U.S. Department of Energy
Assistant Secretary for Environment, Safety and Health

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

Fluor Hanford
P.O. Box 1000
Richland, Washington

INTERIM SAFETY BASIS FOR FUEL SUPPLY SHUTDOWN FACILITY

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M. W. Benecke
Fluor Hanford, Inc.

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Prepared for the U.S. Department of Energy
Assistant Secretary for Environment, Safety and Health

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INTERIM SAFETY BASIS FOR FUEL SUPPLY SHUTDOWN FACILITY

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Key Words: Fuel Supply Shutdown, N Reactor fuel fabrication and storage, N Reactor fuel storage.

Abstract: This ISR, in conjunction with the IOSR, provides the required basis for interim operation or restrictions on interim operations and administrative controls for the facility until a SAR is prepared in accordance with the new requirements or the facility is shut down.

It is concluded that the risks associated with the current and anticipated mode of the facility, uranium disposition, clean up, and transition activities required for permanent closure, are within risk guidelines.

This revision reflects the current operational status and incorporates changes since the original issue of this document May 23, 1995.

[illegible]

**INTERIM SAFETY BASIS FOR
FUEL SUPPLY SHUTDOWN FACILITY**

FLUOR DANIEL HANFORD COMPANY

September 2000

For the U.S. Department of Energy
Contract DE-AC06-96RL13200

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INTERIM SAFETY BASIS FOR FUEL SUPPLY SHUTDOWN FACILITY

1.0 INTRODUCTION AND SUMMARY

1.1 Purpose

This document establishes an interim safety basis (ISB) for the Fuel Supply Shutdown Facility (FSS) in accordance with the requirements of the Project Hanford Management Contract procedure (PHMC) HNF-PRO-700, *Safety Analysis and Technical Safety Requirements*. Recent U.S. Department of Energy (DOE) Orders, DOE Order 5480.21, *Unreviewed Safety Questions* (USQ), DOE Order 5480.22, *Technical Safety Requirements* (TSR), and DOE Order 5480.23, *Nuclear Safety Analysis Reports* (SAR), impose requirements to upgrade nuclear facility safety documentation.

This ISB and supporting analyses provide the required basis for the transitional activities identified for the FSS to be transferred to the environmental restoration division of DOE. Also, the ISB and supporting analyses provide the authorization basis for consideration of USQ issues as defined in DOE Order 5480.21 and HNF-PRO-062, *Identifying and Resolving Unreviewed Safety Questions*.

1.2 Status of Facility Improvements

The facility is currently undergoing transition activities required for permanent closure and transfer to the Environmental Restoration Contractor (ERC) for decontamination and decommissioning (D&D). In this context, improvements are measured in terms of progress made in implementing activities documented in a shutdown plan (Metcalf 1996). The removal of bulk chemical inventories was completed in April 1991, and disposal of the unirradiated uranium inventory is in progress. Transfer of an additional 706 metric tons of uranium (in the form of extrusion billets) to the United Kingdom was completed in September 1996, and activities associated with disposal and/or interim storage of the remaining inventory are continuing. Decontamination and waste disposal activities are also in progress.

1.3 Safety Basis Documentation Upgrades

At the time of facility shutdown, applicable safety bases were limited. This ISB has been prepared to be responsive to the "Implementation Plan for DOE Orders 5480.21, 5480.22, and 5480.23," Reference Letter, J. M. Knoll, Westinghouse Hanford, to R. D. Larson, DOE Richland Field Office (RL), same subject, 9257875, dated October 28, 1992. The following safety analyses have been prepared to support this ISB:

Facility Hazard Analysis (Johnson and Brehm 1994)

A facility hazard analysis has been prepared by a multi-disciplined team including representatives from FSS to identify hazards, energy sources, potential accidents and sequences, targets for potential accident consequences, available mitigating barriers, and qualitative accident severity levels. The most significant accidents are evaluated further in the accident safety analysis. Hazards and potential accidents were evaluated for each FSS building, including the non-uranium storage buildings.

Accident Safety Analysis and Associated Dose Consequences (Johnson 1994)

Accident safety analysis scenarios have been analyzed based on the significant events identified in the facility hazard analysis (Johnson and Brehm 1994) and the fire hazard analysis (Myott 2000) using site specific meteorological conditions and analysis methodology. The results are summarized in Section 1.6.

Fire Hazards Analysis (Myott 2000)

Fire hazards analyses have been prepared that address FSS and associated fire and safety systems, the fire loading and potential fire exposure, fire systems, and Hanford Fire Department response to fires. These have established a basis for the accident safety analysis (Johnson 1994) and the fire criticality probability analysis (Kelly 1995).

Fire Criticality Probability Analysis (Kelly 1995)

This probability analysis shows that no credible accident scenario is postulated that could result in a criticality. Therefore, per DOE 5480.24, Nuclear Criticality Safety, a criticality detection and alarm system is not required.

Criticality Safety Evaluation (Schwinkendorf 1995)

Criticality safety support calculations for FSS have been performed to update values currently found in the criticality prevention specifications. In addition, certain accident or upset conditions were analyzed. These scenarios include fire, the bringing together of multiple masses into one neutronically coupled system, mis-stacking, and accidental interspersed moderation.

Hazard Classification (Benecke 2000a)

A hazard classification has been prepared for FSS in accordance with DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports* (DOE 1992d). This has been updated to reflect a reduction of hazards resulting from facility shutdown activities.

The hazard categorization was prepared based on a conservative Material At Risk for FSS based on the bounding accident (see Section 3.2.1). FSS uranium fuel storage buildings have been assigned a hazard classification of Nuclear Facility, Category 3; other FSS Buildings are classified as Radiological or Industrial.

Interim Operational Safety Requirements (Benecke, et al., 2000b)

Interim Operational Safety Requirements (IOSR) have been prepared based on this ISB.

1.4 Summary of Management Configuration Systems

During shutdown and fuel disposal activities, essential services and buildings will be maintained in a safe and stable environmental condition to protect personnel, the public, and property in accordance with appropriate requirements. Essential systems to be maintained are addressed in the shutdown plan (Metcalf 1996).

The following facility specific and site generic configuration management control systems regulate the operation and configuration of FSS:

Interim Operational Safety Requirements (Benecke, et al., 2000b)

The principal FSS administrative controls that are the basis for the safety envelope and associated accident safety analyses and, as such, must be maintained for the validity of the safety envelope are identified in the Interim OSRs (Benecke 2000b).

Classification of Safety Systems

Accidents with significant consequences have been analyzed. Although the unmitigated maximum chemical releases challenge the Risk Evaluation Guidelines of HNF-PRO-704, the fire suppression components of the fire protection systems of the fuel storage buildings are not classified as Safety Significant. This determination is based on the fire loading of the 3712 Building and the associated worst case fire. Refer to Table 1.6.1 for a comparison of criteria and calculated radiological consequences and toxicological concentrations for the maximum release.

Generic Institutional Controls and Safety Programs

The generic institutional controls and safety programs to assure maintenance of FSS in a configuration that supports the defined safety envelope include the following:

- Radiation Protection,
- As Low As Reasonably Achievable (ALARA),
- Occupational and Industrial Safety,
- Fire Protection,
- Industrial Hygiene,
- Criticality Safety,
- Training,

- Radioactive Waste Management,
- Occurrence Reporting,
- Quality Assurance,
- Configuration Management,
- Conduct of Operations,
- Emergency Planning,
- Maintenance, and
- Environmental Protection

A matrix of the above Institutional Controls or Safety Requirements, DOE Orders and Titles, the Hanford Generic Institutional Controls and Project Hanford Procedures, and FSS-Specific Controls is contained in Table 4.0-1.

Design features that are directed at preventing criticality and reducing dose consequences associated with accidents and that are necessary to be maintained are discussed in Section 3.2.1 of this ISB.

1.5 Summary of Safety Analyses

Safety analyses have been performed for FSS to establish a technical justification for the ISB conclusion that FSS does not represent an undue risk to the public, employees, or the environment. The analyses provide a basis for FSS Interim Operational Safety Requirements. This report summarizes and references the several safety analyses that were performed and describes the rationale upon which it was concluded that the current and future FSS cleanup, fuel storage, and fuel handling and packaging activities associated with anticipated uranium disposition are within the risk guidelines. Additionally, none of the postulated accident consequences exceed the Safety Class criteria of HNF-PRO-704.

1.6 Conclusions

A hazard classification (Benecke 1999a) has been prepared for the facility in accordance with DOE-STD-1027-92 resulting in the assignment of Hazard Category 3 for FSS Buildings that store N Reactor fuel materials (303-A, 303-B, 303-G, 3712, and 3716). All others are designated Radiological or Industrial buildings.

It is concluded that the risks associated with the current and planned operational mode of FSS (uranium storage, uranium repackaging and shipment, cleanup, and transition activities, etc.) are acceptable. The potential radiological dose and toxicological consequences for a range of credible fires, including a uranium storage building fire, have been analyzed using Hanford accepted methods. Because the probability of the unmitigated uranium storage building fire (approximately 1 E-04/yr) is on the cusp between “unlikely” and extremely unlikely” events, event consequences are compared with the Risk Evaluation Guidelines from HNF-PRO-704, Hazard and Accident Analysis Process, for both event categories, in Table 1.6-1. Although the fire suppression systems in those storage buildings are not designated as Safety Significant, controls are established to ensure the availability of those systems, resulting in the event probability being “extremely unlikely”. These controls include, as appropriate, independent

verification of components and valve positions following system changes, component replacement and maintenance. Testing, inspection, and maintenance to NFPA requirements is also performed, subject to exemptions granted to the DOE.

It is also concluded that because an accidental nuclear criticality is not credible based on the low uranium enrichment, the form of the uranium, and the required controls, a Criticality Alarm System (CAS) is not required as allowed by DOE Order 5480.24.

Table 1.6-1. Risk Evaluation Guidelines Comparison with Maximum Potential Consequences

CRITERIA OR EVENT	Unmitigated Consequences		Mitigated Consequences	
	Onsite ^a	Offsite ^a	Onsite ^a	Offsite ^a
Unlikely Events (HNF-PRO-704 Guidelines)	250 mSv (25 rem) EDE	50 mSv (5 rem) EDE ^a	TEEL- 2 ^c Be: 25 µg/m ³ U: 0.6 mg/m ³	TEEL-1 ^b Be: 5 µg/m ³ U: 0.6 mg/m ³
Extremely Unlikely Events (HNF-PRO-704 Guidelines)	1 Sv (100 rem) EDE	250 mSv (25 rem) EDE	TEEL-3 ^d Be: 100 µg/m ³ U: 10.0 mg/m ³	TEEL-2 Be: 25 µg/m ³ U: 0.6 mg/m ³
Maximum Release (8 hr fire in 3712 Building)	50 mSv (5.0 rem) EDE	3.2 mSv (320 mrem)	Be=68.6 µg/m ³ U=5.1 mg/m ³	Be=4.6 µg/m ³ U=0.35 mg/m ³

*Probability of unmitigated uranium storage building fire is "unlikely".

a EDE - Effective Dose Equivalent (from HNF-PRO-704).

b TEEL-1 - Temporary Emergency Exposure Level No. 1 (from Craig 1998).

c TEEL-2 - Temporary Emergency Exposure Level No. 2 (from Craig 1998).

d TEEL-3 - Temporary Emergency Exposure Level No. 3 (from Craig 1998).

e Onsite – 100m east.

f Offsite – 490 m east at adjacent river edge.

2.0 SITE, FACILITY, AND ORGANIZATION DESCRIPTION

2.1 Hanford Site and 300 Area Description

The DOE Hanford Site lies within the semi-arid Pasco Basin, part of the Columbia Plateau in southeastern Washington State (Figure 2.1-1). The Hanford Site occupies an area of about 1,500 km² (560 mi²) and is about 48 km (30 mi) north to south and 38 km (24 mi) east to west. This land area, with restricted public access, presently provides a buffer for the smaller areas currently used for nuclear materials storage, waste storage, and waste disposal. The Columbia River flows through the northern part of the Hanford Site, and forms part of the eastern boundary as it turns south. The Yakima River runs along part of the southern boundary

as it turns south. The Yakima River runs along part of the southern boundary and joins the Columbia River near the City of Richland. Adjoining lands to the west, north, and east are principally range and agricultural land. The cities of Richland, Kennewick, and Pasco (known as the Tri-Cities) comprise the nearest population center and are located southeast of the Hanford Site.

Figure 2.1-2 shows the facilities on, and the land use of, the Hanford Site. The Hanford Site was initially established in 1943 for production of plutonium by the U.S. Government through the exercise of eminent domain for the Manhattan Project. Current activities on the Hanford Site include lay up of Fast Flux Test Facility (FFTF) reactor, lay up of fuel reprocessing plants, waste management, laboratory operations, ecological studies, and operation of the Energy Northwest Nuclear Plant No. 2.

Figure 2.1-1. Location of the Hanford Site.

SG98030065.2

Figure 2.1-2. Hanford 300 Area Detail.

The 300 Area occupies about 1.6 km² (0.6 mi²) of land. See Figure 2.1-2 for the principal 300 Area buildings. The 300 Area is located within the southeast corner of the Hanford Site. It is bounded by the Columbia River on the east and by the Hanford Site Route 4 to the west. The Hanford Site's southern boundary is about 1.7 km (1.1 mi) north of the Richland city limits and about 11 km (6.8 mi) north of the city center. The nearest residence to the 300 Area is about 1.5 km (0.9 mi) to the east, across the Columbia River. A number of irrigated farms are located immediately across the river from the 300 Area. The nearest city water intake is the Richland city pumping station 6 km (3.7 mi) downstream from the 300 Area.

2.2 Fuel Supply Shutdown Facility

2.2.1 Background and Facility Description

The facility is managed by the Fuel Supply Shutdown organization reporting to the Accelerated Deactivation Project within the River Corridor Project. The facility is located in the northeast corner of the 300 area (see Figure 2.2.2-1). The facility includes the following buildings with noncontiguous boundaries: 313, 333, 303-A, 303-B, 303-E, 303-G, 303-K/3707-G, 303-M, 304, 334 (and Tank Farm), 334-A, 3712, 3716, MO-052 (office trailer), and the Outside Storage and Transfer System including the 311 Tank Farm and the 303-F pump house.

Underlying the area to the east of the 333 Building is an inactive low-level radioactive solid waste burial ground (current Hanford Site waste management identification number 618-1, formerly referred to as 300 Area No. 1 Burial Ground). The burial ground and activities involving it are not addressed by this ISB; the burial ground is a part of the "Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)" (WHC 1989).

The history of the facility began in 1943 when the 313 Building was constructed to house manufacturing equipment for production of fuel for the Hanford single pass reactors. Fuel production began in mid-1944 and continued through the early 1950s. The facility was then expanded to allow for increased fuel production. In the late 1960s, a process, which included nickel plating of the bare uranium cores prior to cladding, was developed and installed. This process continued until 1971, when the six production lines were shut down concurrent with the shutdown of the single pass reactors. Other programs conducted near the 313 Building include support of a tritium production program from 1948 to 1952 and a thorium program in the mid 1960s. For N Reactor fuel fabrication, the 313 Building housed a waste treatment system, administrative offices, and training and warehouse space. This building also housed a complete N Reactor pressure tube fabrication facility consisting of a 4000-ton Sutton extrusion press, draw bench, grinders, an autoclave, inspection equipment, and chemical cleaning equipment. The Hanford Metal Working process equipment has been sold to a commercial company, and the north section of the 313 Building has been leased for the commercial operation of the extrusion equipment.

The 333 Building, constructed in 1958, houses the primary fabrication equipment for manufacturing N Reactor fuel, which began in 1962. From 1965 to 1967, the building was also used to assemble lithium aluminate targets for demonstration of co-production in the N Reactor. The building contained equipment for all operations from initial component cleaning to finished

fuel assembly, inspection, and packaging for shipment. Fabrication activities continued until N Reactor entered the standby phase in 1987, and at that time, the facility also began transition to standby status. Other buildings comprising the facility provide storage space for fuel materials and finished fuel, and contain residual process equipment that supported fuel production. At this time, the Fuel Supply Shutdown complex is in transition from standby status and undergoing cleanup and shutdown activities required for permanent closure and transfer to D&D. The individual buildings are listed in Table 2.2.1-1 with their function/activity and facility classifications.

Table 2.2.1-1. Fuel Supply Shutdown Facility Building Identification, Current Function/Activity, and Hazard Category.

BUILDING	CURRENT FUNCTION/ACTIVITY	HAZARD CATEGORY*
303-A	Fuel Storage (122 MTU)	Nuclear Cat 3
303-B	Fuel Storage (52 MTU)	Nuclear Cat 3
303-E	Empty**	Industrial
303-F/311-Tank Farm	Pump House/Outside Chemical Storage and Transfer System	Industrial
303-G	Uranium Billet Storage (210 MTU)	Nuclear Cat 3
303-K/3707-G	RCRA Closure/UF ₆ (3.5 MTU) & ThO ₂ (0.5 MT) Storage	Radiological
303-M	Uranium Oxide Facility (Shutdown)	Industrial
304	RCRA Clean Closed (Empty **)	Industrial
313	RCRA Closure/(Metal Fabrication in North end by private enterprise)	Industrial
333	Offices/Cleanup/RCRA Closure	Industrial
334 and Tank Farm	Empty**	Industrial
334-A	RCRA Closure	Industrial
3712	Finished Fuel, Billet, and Scrap Storage (675 MTU)	Nuclear Cat 3
3716	Unfinished Uranium Fuel Storage (137 MTU)	Nuclear Cat 3
MO-052	Offices	Industrial

NOTE: MTU = Metric Ton Uranium.

* Facility Hazard Category (See Section 3.1.1).

** Empty signifies no fuel materials, hazardous materials, or equipment.

2.2.2 Building Description, Construction, and Status

Descriptions of the individual nuclear facility buildings including their size, construction, fire protection systems, and status are included below. See Figures 2.1-2 and 2.2.2-1 for layout of the buildings with respect to other buildings in the 300 Area. Individual building layouts are shown in figures 2.2.2-2, 2.2.2-3 and 2.2.2-4.

Buildings 303-A, 303-B, 303-E, 303-G Billet/Fuel Storage.

Description: The structures are single story, 120.4 m² (1296 ft²), 8.2 m by 14.6 m (27 ft by 48 ft), concrete block and cement construction, three doors, no windows. Roofs are 46 cm (18 in.) precast concrete slabs covered with felt, tar, and gravel. There are four 25 cm (10 in.) diameter holes in the walls at floor level for water drainage. The buildings are unheated. Except for 303-E, which has had its fire protection system shut down, the buildings are equipped with automatic fire alarm and sprinkler (dry) systems with freeze protection in the valve rooms.

Status: Three buildings are used for fuel and billet storage. 303-A and 303-B contain unirradiated fuel elements (wrapped in plastic) taken from N Reactor which were contaminated with fission and activation products (max removable contamination approximately 50,000 dpm). The 303-G Building contains uranium billets. The billets and fuel are stored in wooden boxes. The 303-E Building was formerly used to store fuel and is now empty. Buildings are kept locked and Tamper Indicating Device (TID) sealed when unoccupied and fissionable material is being stored. 303-E is not currently TID-sealed.

Building 3712 Finished Fuel, Billet and Scrap Storage

Description: The 3712 Building is a one story steel frame structure, 27.4 m x 32.9 m (90 ft by 108 ft), with metal panel siding and roof, with a concrete floor and foundation. It is equipped with an automatic fire alarm and sprinkler (dry) system with freeze protection in the valve room. The steam heated forced air system has been disconnected. There are no floor drains. The building floor is at or above grade, and the structure is supported approximately 8 in. above the floor on a concrete curb. Water accumulation would naturally be retained by this curb; however, there are two 5 m (16 ft) wide roll-up doors, with 11 cm (4.5 in.) high flaps at the bottom for drainage and two 2 m (8 ft) and two 1 m (3 ft) doors. An insulated wall divides the north and south ends. The south end is also served by an electric recirculating positive pressure HVAC system (with no stack), which is used only when the area is occupied.

Status: The building is used for storage of uranium billets and finished fuel in wooden boxes, uranium scrap and standards, and unfinished fuel pieces. The south end of the building was modified to support the campaign to repackage billets for shipment to the United Kingdom. This area may be used in the future to support fuel relocation efforts. The building is kept locked and TID-sealed when unoccupied and fissionable material is being stored.

Building 3716 Unfinished Uranium Fuel Storage

Description: The 3716 Building is a single story, 12.2 m by 24.4 m (40 ft x 80 ft) aluminum frame building with corrugated aluminum siding and roof. The building is equipped with an automatic alarm and a sprinkler (dry) system with freeze protection in the valve room. It has a grate at the bottom of the west roll-up door for potential water drainage.

Status: The building is used for storage of unfinished fuel pieces capped with plastic caps in wooden boxes. Building is kept locked and TID-sealed when unoccupied and fissionable material is being stored.

Figure 2.2.2-1. Fuel Supply Shutdown Facility Layout

Figure 2.2.2-2. Buildings 303-A, 303-B, and 303-G

==: 10" dia drain hole at floor level

Each hutment has a 4' and a 5' wide door on one end and a 3' wide door on the other end.

Figure 2.2.2-3. Building 3712

Figure 2.2.2-4. Building 3716

2.2.3 Current and Planned Operational Mode

The transition from standby to the shutdown phase began in March 1992. Three major areas of work are planned for completion in fiscal year (FY) 2001, or earlier, if the necessary funding is provided: consolidation and disposition of the uranium fuel, completion of work defined in the RCRA Closure Plans, and shutdown and cleanup of the remaining facility for turnover to the D&D organization. The FSS operating staff currently manages these activities and provides surveillance and basic maintenance for the facility. The operations staff is also involved with the disposal of essential materials and waste.

A significant unirradiated uranium inventory, present at the time N Reactor standby was announced, is stored in the facility. Of the 1200 metric tons uranium (MTU) remaining in the facility (303-A: 122 MTU, 303-B: 52 MTU, 303-G: 210 MTU, 3712: 675 MTU, and 3716: 137 MTU) a major portion consists of 0.95 wt% to a maximum of 1.25 wt% U-235 enrichments now packaged in wooden boxes. Less than 80 MTU is natural or depleted uranium. Some of the uranium is in the form of extrusion billets. The majority of the uranium inventory is in the form of fuel elements, some of which were partially fabricated at the time operations ceased. A portion of the fuel had been loaded into N Reactor, but was never irradiated and later returned for storage at the facility. This fuel has low-level fission and activation radionuclide surface contamination (see Table 2.2.6-1). The uranium will require storage at the facility until an alternate storage facility or specific use/user has been identified. The storage buildings will require continuing surveillance, including building and system maintenance, active fire systems (except for the oxide materials in 303-K), safeguards and security, and regulatory compliance until the uranium has been relocated for alternate storage or use.

Several RCRA Closure Plans have been prepared for several of the non-uranium storage buildings, (DOE-RL 1989, DOE-RL 1990a, DOE-RL 1990b, and DOE-RL 1991). The RCRA closures for these buildings are expected in FY 2000 (provided that required funding is available), prior to turnover to the D&D organization. Besides the RCRA closure, the non-uranium storage buildings will require removal of radioactive and hazardous wastes, cleanup and/or stabilization of radioactive/contaminated areas and process equipment, removal of excess materials, and disposition of assets prior to acceptance into the D&D program.

Removal of bulk chemical inventories was completed in April 1991. The cleanup of uranium residues from fabrication equipment was completed in FY 1994. Cleanup has minimized radiological concerns and eliminated the risk of spontaneous or accidental fires involving residual pyrophoric uranium chips and fines.

This ISB will cover the facility throughout the cleanup and shutdown activities, fuel storage operations, and limited fuel handling and packaging for shipment elsewhere until turnover to the D&D organization. Limited fuel handling and packaging is defined as limiting each fuel handling evolution to quantities less than the minimum hemispherical safe mass quantities (Schwinkendorf 1995).

2.2.4 Major Nuclear Facility Processes and Facility Segments

With cleanup and shutdown activities underway, "major processes" no longer applies to existing conditions. Using a graded approach, only systems that provide or support the uranium storage function and anticipated uranium disposition activities, including limited fuel handling, are identified and addressed in this LSB. Buildings in which uranium fuel is being stored require periodic surveillance for fire systems, maintenance, safeguards, and regulatory and DOE compliance.

It is anticipated that handling and packaging of uranium fuel for disposal and temporary storage of the packaged material, as in the case of recent billet shipments to the United Kingdom, will occur.

2.2.5 Facility Support Systems

2.2.5.1 Heating, Ventilation, and Air Conditioning (HVAC)

Only the 3712 Building has an active heating or cooling system. Installation of a recirculating positive pressure electric HVAC with no stack in the 3712 Building billet repackaging area was completed in 1996. The occupied portion of the 333 Building and MO-052 also have active HVAC systems.

2.2.5.2 Electrical Power

Offsite power is supplied from the Bonneville Power Administration (BPA) network to the 115-kV/13.8 B3-S4 substation in the 300 Area. The 300 Area 13.8-kV distribution lines supply a variety of office, laboratory, and fabrication facilities in the 300 Area.

Two separate lines run through the 300 Area distribution system to the C-3-3 switching station and then to the facility 13.8-kV/480-V substation. The power is used for residual required functions, i.e., HVAC, lighting, offices, heating of the fire protection valve enclosures, fire protection alarm systems, etc.

There is no requirement for emergency power to the facility.

2.2.5.3 Water Systems

Water for the facility is supplied from the 300 Area water supply system. This distribution network supplies both the sanitary and fire protection water for the entire 300 Area. It consists of multiple supply pumps, a filter plant, a chlorine addition system, and distribution network that are supplied by the City of Richland. In addition, two head tanks provided on the network ensure a 4-hour supply at 4100 gpm in case the normal supply pumps fail or the backup engine driven pumps fail to start. These backup pumps start automatically upon loss of pressure in the distribution line. As appropriate, the water supply system is separated into fire protection, sanitary water, and process water systems at the facilities. The distribution system is a closed loop system that allows for multi-direction feeds to 300 Area facilities.

With the fuel fabrication operations shut down, the primary water usage is sanitary and fire protection.

2.2.5.4 Drains, Trenches, and Process Sewer System

No sanitary drains exist in the 303-A, 303-B, 303-G, 3712, or 3716 Buildings. Floor and trench drains in the 3716 Building connect to the 300 Area Treated Effluent Disposal Facility (TEDF).

When the Facility Effluent Monitoring Plan (FEMP) (Nickels and Brendel 1991) for the facility was published, the facility fuel fabrication activities were no longer being performed. Routine liquid effluent discharge to the 300 Area process sewer has been decreasing ever since and is now limited to storm water. However, there is potential for liquids to enter the process sewer from fire protection water release and storm water. The facility was reevaluated in the Hanford Site Plan and it was determined that no changes were required (DOE 1997).

2.2.6 Radioactive and Hazardous Wastes

2.2.6.1 Liquid Wastes

The principal facility liquid waste discharges to the 300 Area Process Sewer are precipitation and controlled and non-controlled fire protection system releases. A complete description of the discharges to the process sewer system is contained in the FEMP (Nickels and Brendel 1991). There are no anticipated radioactive liquid waste discharges.

There are no releases or interconnections to the shutdown 300 Area 340 Radioactive Liquid Waste System.

Since the facility mission has changed from operations to shutdown and no longer releases effluents to the environment, the facility was reevaluated using the FEMP determination process, and it was determined that no FEMP is required (Frazier 1994).

2.2.6.2 Radioactive Gaseous Wastes

The exhaust and HEPA filter systems associated with specific fuel manufacturing processes and equipment that had the potential for generating airborne contamination were shut down and blanked off. With this shut down, there are no anticipated radioactive gaseous waste discharges from these sources.

Radioactive air emissions from facility shutdown and deactivation activities are expected to be minimal. However, emissions from these activities will be controlled through the use of pollution controls described in a Notice of Construction (AIR 1997).

2.2.6.3 Radiological Hazardous Waste

Wastes generated from activities associated with the transition from standby to shutdown consist primarily of cleaning materials and those associated with cleanup of the radiological surface-contaminated and RCRA areas. The hazardous wastes include residual beryllium (Be) and asbestos. The waste management details are described in *the Low Level, Mixed, Hazardous and Nonregulated Waste Certification Plan for Facility Operations/N Reactor Plant/Fuel Supply Facilities* (Weakley 1993). The certification process waste generation criteria include:

- Controls to reduce waste generation
- Establishment of waste minimization programs
- Segregation of low level, mixed, hazardous, and nonregulated waste
- Low level, mixed, hazardous, and nonregulated waste management
- Incorporation of design principles to minimize waste generation
- Waste treatment
- Audits
- Annual update of 30-yr forecast.

Normal radiological dose rates and contamination levels associated with the facility are included in Table 2.2.6-1. These dose rates are from residual fixed and removable residual uranium and uranium compounds resulting from the fuel manufacturing process. Some trenches and drains also contain small residual uranium and various uranium compound contamination. There is no history of mixed fission product or activation product contamination despite the presence of the contaminated fuel in the 303-A and 303-B Buildings (see Table 2.2.6-1).

The facility total dose impact associated with the eight facility radiation workers and their three supervisors was less than 1.1 rem for calendar year 1996, when 700 MT of uranium billets were individually repackaged for shipment to the UK. Exposures are documented in Facility Radiological Exposure Status Reports. Future facility dose impact is expected to be less until uranium repackaging/disposition activities resume.

Table 2.2.6-1. Facility Radiological Dose Rates and Contamination Levels.

LOCATION	MAXIMUM DOSE RATE	GENERAL AREA DOSE RATE	FIXED CONTAMINATION LEVELS (MAXIMUM)	REMOVABLE CONTAMINATION LEVELS (MAXIMUM)
303-A*, B*, E**, G Fuel Storage	7 mrem/hr	4.5 mrem/hr	60,000 dpm beta-gamma <1,000 dpm alpha	Not applicable
3712 Fuel & Billet Storage	7 mrem/hr	1.5 mrem/hr	<1,000 dpm beta-gamma <20 dpm alpha	25,000 dpm beta-gamma 1,400 dpm alpha
3716 Unfinished Fuel Storage	7 mrem/hr	3 mrem/hr	<1,000 dpm beta-gamma <20 dpm alpha	Not applicable

* Unirradiated fuel assemblies potentially surface contaminated with activation and fission products. Maximum removable contamination approximately 50,000 dpm.

** Former fuel storage, dose rates, and contamination levels are lower than the maximum levels tabulated for buildings 303-A, B, and G.

2.2.7 Fuel Supply Shutdown Facility Organization

The Fuel Supply Shutdown (FSS) Project organization is described in FSP-FSS-5-35, *Fuel Supply Operations Control Manual*. The FSS Project is part of the Fluor Daniel Hanford River Corridor Project.

The organization is comprised of management and clerical personnel, cognizant engineers, hazardous waste specialist, and metal operators who are responsible and perform duties required for management, operation, surveillance, maintenance, RCRA, and facility cleanup and shutdown.

2.2.8 Principal Interfaces and Support

Organizations interfacing with and providing support to the Fuel Supply Shutdown Project include:

- DynCorp (maintenance, transportation, and fire protection services)
- Fluor Daniel Northwest (safety analysis and evaluation services)
- Fluor Daniel Hanford (quality assurance, safety, environmental assurance, analytical services, and waste services).

2.2.9 Facility Access Control

The facility is within the fenced 300 Area where pedestrian gates and vehicle gates are unlocked.

The 333 Building is locked except during occupied shifts. Scramble pad control access is utilized during off shifts. The scramble pad code is issued to occupants, service personnel, Hanford Patrol, Fire Department, and other support personnel. All other buildings remain locked unless opened for specific surveillances, maintenance, or cleanup activities.

Tamper-indicating devices (seals) are also used on doors into active SNM storage areas: 303-A, 303-B, 303-G, 303-K (south), 3712, and 3716.

2.3 Facility Fire Protection

Elements of the fire hazards analysis (Myott 1999) have been included in this document. Each of the unheated uranium fuel storage buildings is equipped with an automatic fire alarm and dry sprinkler system with freeze protection in the valve rooms. The sprinkler and alarm systems were installed in the mid-1980s to contemporary standards at the time and are maintained to applicable National Fire Protection Association codes and standards, subject to exemptions granted to DOE-RL per HNF-PRO-351. Sprinkler/alarm systems are also installed in the 333 Building, and manual pull stations are located inside and outside the building's rooms, and any

operation of these systems annunciates to the Hanford Fire Department Stations. In addition, telephones are located inside non-fuel storage buildings and are available for contacting the Fire Department via the site 911 emergency notification protocol.

The facility fire protection alarm system is part of the Hanford Fire Department Station No. 92 radio fire alarm reporting system. Trouble alarms (valve tamper, low air pressure, low temperature) are in series for each building. Actuation of a trouble alarm or fire alarm (system water flow) will sound in the Hanford Fire Department Station No. 92 Central Dispatch office, alerting people in this continuously manned area of this condition. The Station No. 93 on-shift crew will then be dispatched to investigate. Unless there is an actual fire, the crew will notify Fire System Maintenance to take action to mitigate the concern.

The normal water supply to the facility fire protection systems, both the sprinklers and outside hydrants, is the 300 Area sanitary water system. This closed loop system allows multi-direction water feed to each fuel storage building. A 1.4 -million gallon supply reserved for fire protection is maintained in two head tanks with delivery assured by two dedicated diesel powered fire pumps, each with 3000 gpm capacity, that start automatically upon loss of line pressure.

Additional information on the sprinkler and alarm system, capacities and response to fires, and associated maintenance and surveillance are contained in the fire hazard analyses (Myott 1999).

2.3.1 Hanford Fire Department

The Hanford Fire Department consists of four stations:

- Hanford Fire Department Station No. 91 is located in the 100 Area and is about 53 km (33 mi) away, (this station is only open Monday – Friday, day shift).
- Hanford Fire Department Station No. 92, the 609-A Building, is located to in the 200 Area, and is about 35 km (22 mi) away,
- Hanford Fire Department Station No. 93, the 3709-A Building, is located at the southeast corner of the 300 Area and is about 0.4 km (0.25 mi) away, and
- Hanford Fire Department Station No. 94, 4709-A Building, is located at the 400 Area, about 9.6 km (6 miles) away.

The Fire Department Stations and engines are equipped with separate radio systems for communication during emergencies.

Fire Systems Maintenance personnel periodically inspect and test the fire protection systems and equipment in accordance HNF-PRO-351, "System testing/Inspection and Maintenance," which addresses inspection, testing, and maintenance. HNF-PRO-351 also defines the minimum frequencies of these activities. A qualified fire protection engineer

performs independent verification of component identification following system modification. FSS personnel perform independent verification of proper valve positions following maintenance on the fire protection systems.

Further information on the Hanford Fire Department, protection systems, and associated operation, maintenance and surveillance, training requirements, and response times is contained in the fire hazard analyses (Myott 2000).

2.4 Nearby Facilities and Activities

Following is information on nearby facilities operated by other Project Hanford organizations and Pacific Northwest National Laboratory (PNNL) that were considered to have the potential for impacting the facility. Nearby FSS Buildings were also considered.

3720 Central Services Laboratory

The 3720 Central Services Laboratory was built in 1959 on the site of the old 3722-A Building, and was used by General Electric, Douglas United Nuclear, and United Nuclear Industries for analytical chemistry work in support of Hanford Works reactors in the 1960s and early 1970s. It is a two-story metal frame structure, 73.2 m by 30.5 m (240 ft by 100 ft), erected on a concrete foundation, footings, and floor slab, with a basement 7.3 m by 33.2 m (24 ft by 109 ft) under the southwest corner. In 1980, a one-story concrete block addition, 14.6 m by 12.2 m (48 ft by 40 ft), was constructed on the north end, giving the structure a total area of nearly 2,323 m² (25,000 ft²). The addition contained general laboratory and office facilities.

The building, now called the Central Services Laboratory, has been used by PNNL for vitrification and grout developmental experiments, including radioactive laboratory work. The radioactive and other hazardous material content is relatively small, and the facility is classified a fissile exempt facility. The building is scheduled to be vacated by the end of CY 2000.

To the south of the 3720 Building is an underground propane tank, [about 28 m (90 ft) north of 3712] which has not been used for several years and is not scheduled to be placed back in service. Inspection has shown it to be empty and disconnected from the building.

3720 BA Package Boiler Building

On the south side of the 3720 Building and approximately 24 m (80 ft) north of the 3712 Building is a natural gas-fired package steam boiler that provides steam to the 3720 Building. Potential impact to the 3712 Building from accidents (boiler explosion, boiler annex fire, jet flame from ruptured gas pipeline) would be minimal since the distance between the two facilities exceeds the minimum separation distances calculated for these accidents (Daling & Graham 1997). Other fuel storage buildings are farther away.

Potential use of a mobile diesel-fired package boiler when the primary natural gas fired package boiler is out of service was considered. Although this unit, which has a 1000-gallon diesel tank associated with it, could theoretically add to the combustible loading of the nearby

3712, initiation of a fire in the 3712 Building resulting from an accident involving the diesel-fired mobile package boiler is not credible. Events considered were a) vehicle impact and resulting spill, and b) an upset associated with diesel transfer from the delivery truck into the package boiler tank.

The Washington State boiler inspector estimates that there are approximately 10 instances/year where an emergency boiler is installed. Total number of power boilers (>15 psi steam or 160 psi hot water) and firetube boilers in the state is 3059. This number does not include industrial use hotwater heaters and cast iron boilers, also licensed by the state and estimated at 8,000 – 10,000 units, which would also employ a backup diesel-fired mobile unit if the primary unit failed (Murphy 1999). Using only the number of power boilers and firetube boilers as the basis to ensure that backup boiler use is not underestimated translates to a probability of backup boiler installation of $3.3\text{E-}03$ per year.

Vehicle impact with the backup package boiler unit could threaten the nearby 3712 Building. The Utah Department of Transportation, Division of traffic and Safety, Safety Studies Section (Utah 1999) reports a vehicle accident rate for 1996 of 3.17 accidents per million vehicle-miles traveled. Assuming that this rate should encompass the accident rate within the fenced 300 Area of the Hanford Site, that the effective target width of the package boiler is less than 50 ft, and that the number of vehicles passing the package boiler site is estimated at less than 25/day, an accident rate involving the package boiler is calculated by:

$$3\text{ E-}06 \text{ acc/vehicle mi.} \times 25 \text{ vehicle passes/day} \times 50 \text{ ft} \times \text{mi}/5280 \text{ ft} \times 365 \text{ day/yr} = 2.6\text{ E-}04/\text{yr}$$

Because all traffic passing the package boiler would be moving at low speed, the actual probability of vehicle impact should be less. Furthermore, diesel ignition from the postulated low-speed accident should be no more likely than 50%. Then, because the boiler surroundings slope gently toward the 3712 Building, the burning spill would probably reach the building exterior. However, because the vehicle occupant should be capable of summoning the Hanford Fire Department since any injuries suffered from the low-speed accident are expected to be minor, HFD arrival to extinguish the fire prior to ignition of the uranium fuel boxes is assigned a conservative probability 0.5. Overall probability of the 3712 Building contents catching fire because of a vehicle crashing into the backup diesel-fired boiler is then $2.1\text{ E-}07/\text{yr}$ which is not credible ($3.3\text{ E-}03 \times 2.6\text{ E-}04 \times 0.5 \times 0.5 = 2.1\text{ E-}07$).

Another scenario capable of resulting in a significant diesel spill results from an upset occurring when the diesel tank is being filled. Probability of impact by the delivery truck should be enveloped by the vehicle accident rate described above. Still another scenario is for a spill occurring while transferring diesel from the delivery truck to the package boiler supply tank resulting from either human error [frequency estimated at $1.0\text{ E-}02$ (Gertman 1994)] or

equipment failure (frequency estimated at $1.0 \text{ E-}02$) and then failure of the attending personnel to contain the spill using materials associated with the delivery truck and/or adjacent facility frequency estimated at $1.0 \text{ E-}01$. When combined with the probabilities for spill ignition (0.5) and failure to summon the HFD (0.5), this event is also not credible ($8.3 \text{ E-}07$, note that the backup boiler installation probability is included in this value).

Considering that the 3720 Building is scheduled to be vacated at the end of CY 2000, there is not much opportunity for the backup package boiler to be employed.

Comparison of the distance between the package boiler and the next closest fuel storage building, i.e., the 3716 Building, showed that adequate separation exists to prevent its involvement if the mobile package boiler or fuel delivery truck were to catch fire. Calculated minimum separation distances between a larger capacity (40,000 gallons) diesel-fired package boiler and a different target facility (Marusich 1997) were scaled for the smaller diesel tank.

306 Metal Fabrication Development Building

The initial mission for the 306 Building, also known then as the "Met Semi-Works," was to support 313 Building operations and to pilot process improvements in single-pass reactor fuel fabrication methods. Later it was expanded to contain the co-extrusion fabrication process for N Reactor fuel elements.

The overall building dimensions are approximately 55 m by 115.8 m x 7.6 m high (180 ft by 380 ft by 25 ft high), with a total area of $7,447 \text{ m}^2$ ($80,160 \text{ ft}^2$). The building is two stories high, with no basement, and has a framework of bolted steel.

Throughout the history of the 306 Building, its missions have centered on various alloy and fabrication test and development work. The 306 Building continues to operate today, performing a variety of fabrication tasks under joint PHMC/PNNL occupancy.

The 306W (PNNL) Building is essentially shut down except for a few offices.

The 306E (PHMC) Building is classified as a low-hazard radiological facility.

313 North Building

The north end of the 313 Building is under the control of a private company (Richland Specialty Extrusions, a division of Kaiser Aluminum) that is fabricating specialty metal parts, as was discussed in Section 2.2.2. Although the building occupants are private employees, because they are leasing a DOE facility, they are considered site workers. However, no radiological or hazardous material operations are being performed within the facility. The large metal extrusion press located in the 313 Building is used to extrude aluminum metal shapes for commercial use.

To the north of the building are two 1000-gallon above-ground propane storage tanks which were recently (December 1994) installed to current standards for area heating and also to provide heat for the aging/annealing oven. This is the only major energy source at the facility which could significantly impact the adjacent fuel supply building. An accident analysis was specifically prepared for the propane tanks which is discussed in Section 3.2.2.

Nearby FSS Project Buildings

Other nearby FSS Project buildings were examined for potential impact to the fuel storage buildings.

The 303-F and associated 311 Tank Farm are located approximately 20 m (65 feet) south of the 3712 Building and 10 m (33 feet) west of the 303-G Building. Both the 303-F and 311 Tank Farm are empty with all utilities shutdown except for minimal lighting inside 303-F. Neither of these empty facilities represents any risk to the fuel storage buildings.

The 313 South Building is located approximately 24 m (80 feet) west of the 3712 Building. Its distance to the 303-B Fuel Storage Building is even greater. The 313 South Building is shutdown, unoccupied and all utilities have been disconnected except electricity for minimal lighting. There is no credible event originating in 313 South that presents a risk to either the 3712 or 303-B Fuel Storage Buildings.

The 333 Building is located approximately 27 m (90 feet) north of the 3716 Building. Although the 333 Building is the focus of future equipment disposition activities, its combustible material inventory has been significantly reduced from what it was during the time period when the building was the primary N Reactor fuel fabrication facility. Thus, the 333 Building does not represent a risk to the 3716 Building or any other fuel storage building.

The 304 Building is located directly between the 303-A and 303-B Fuel Storage Buildings. This empty building with all utilities disconnected does not represent any risk to either of these fuel storage buildings.

The 303-K Building is located approximately 22 m (73 feet) north of the 303-A and 303-B Fuel Storage Buildings. The south end of this building, which is categorized as a radiological facility, is used to store cans of depleted/natural uranium oxide powder and thorium oxide powder.

that are overpacked in UN1A2 drums and a few FFTF reactor pins containing sintered pellets of these oxides. All utilities to this building have been disconnected except that required to support minimal lighting. There is no credible event originating in this building that could involve any of the fuel storage buildings.

Interface Control

Because of the relative locations of the uranium storage buildings and nearby facilities under the control of other organizations, the likelihood of those organizations performing activities that could interfere with potential water outflow from the uranium storage building criticality drains, or introduce new or increased hazards, is remote. However, implementation of the interface requirements of HNF-PRO-701, *Safety Analysis Process – Existing Facilities*, will provide assurance that the change control processes for those organizations will include FSS personnel in the review of any proposed actions that could affect criticality drain function. Similarly, HNF-PRO-701 implementation will result in the Hanford Fire Department providing for FSS review of any changes that could adversely affect their response to uranium storage building alarms or capability to maintain the fire protection systems of those buildings.

3.0 INTERIM SAFETY BASIS EVALUATION

3.1 Hazard Analysis

3.1.1 Hazard Classification

A hazard classification (Benecke 2000) has been prepared for the facility in accordance with DOE-STD-1027-92 resulting in the assignment of Hazard Category 3 for the FSS uranium fuel storage buildings.

In developing a hazard categorization, the DOE-STD-1027-92 standard allows for the credible radionuclide source term quantity to be compared to the threshold values in the standard. The hazard categorization was prepared based on a conservative, credible material at risk (MAR) associated with the bounding unmitigated accident for the facility using facility-specific values for individual radionuclides and comparing them with Category 2 values.

The MAR was determined from bounding credible event, i.e., an unmitigated fire in the 3712 uranium storage building. The quantity of uranium potentially capable of being oxidized and subject to dispersal in that fire was determined by first estimating the fire duration and temperature profile from the combustible material loading. Next, experimental data obtained from studies using smaller uranium pieces was extrapolated to the billet geometry to estimate the fraction of uranium that would be oxidized (Johnson 1994). This resulted in slightly less than 5% of the building inventory subject to dispersal in the unmitigated fire (see Section 3.2.1). This quantity is compared to the Category 2 Threshold Quantities in Table 3.1.1-1. Facility segmentation is permitted by DOE-STD-1027-92, as long as the hazardous material in one segment (or building) could not interact with the hazardous material in other segments (or buildings) and if no common (and credible) event initiator exists. Since the heating, ventilation,

and air conditioning (HVAC), piping, fire protection (sprinkler), etc., systems are independent among the various fuel storage buildings (i.e., there are no HVAC or process piping systems in these buildings that could allow hazardous material interaction), and there is significant physical separation between the buildings, independence is demonstrated for facility segmentation purposes.

Table 3.1.1-1. 3712 Building Material at Risk Compared to Category 2 Values.

RADIONUCLIDE	3712 BUILDING INVENTORY (Ci)	MAR (Ci) ⁽¹⁾	CATEGORY 2 VALUES (Ci) ⁽²⁾
Uranium-234	391.5	19.3	2.2E + 02
Uranium-235	18.2	0.9	2.4E + 02
Uranium-236	31.7	1.6	5.5 E + 01 ⁽³⁾
Uranium-238	236.2	11.7	2.4 E + 02
Technetium-99	114.7	5.7	3.8 E + 06

(1) Benecke, 2000a.

(2) HNF-PRO-704, Table B-1.

(3) HNF-PRO-704, Table B-1, Footnote (a).

As shown in Table 3.1.1-1, the facility radionuclides associated with the credible MAR are below the threshold values for a Category 2 facility. Also, the sum-of-fractions is less than unity (0.17) (Benecke 2000a). Therefore, the facility is assigned a hazard categorization of Nuclear Facility Category 3. Only those buildings within the facility that store fuel materials are designated Category 3 buildings. All others are designated Radiological or Industrial Buildings (see Table 2.2.1-1).

3.1.2 Potential Accident Scenarios

A hazard analysis (Johnson and Brehm, 1994) has been prepared for the facility. The hazard analysis process included the formation of a team of knowledgeable individuals from the facility and the safety analysis organizations. The team systematically reviewed the facility for all energy sources, potential event scenarios, target consequences, and identified the following range of potentially hazardous event scenarios for further analysis of onsite and offsite dose consequences:

1. Ignition of residual uranium/Zircaloy-2 manufacturing chips and fines during facility and equipment cleanout,
2. Leakage or dryout of water in uranium/Zircaloy-2 chips and fines storage drum that exposed the chips and fines to air, resulting in spontaneous combustion,
3. Ignition of HEPA filter containing uranium, Zircaloy-2, and beryllium metals and compounds during filter removal,

4. Ignition of the uranium/Zircaloy-2 chips and fines that have been imbedded in concrete in a storage drum,
5. Seismic or other induced fire in uranium fuel storage building with fire protection system or Hanford Fire Department mitigation,
6. Seismic or other induced fire in uranium fuel storage building without mitigation, and
7. Multiple fuel stacking errors with introduction of optimum moderation.

Since the hazard analysis has been prepared, several event scenarios are no longer applicable: ignition of residual uranium/Zircaloy-2 chips and fines, leakage or dryout of water in uranium/Zircaloy-2 chips and fines storage drums, and ignition of uranium/Zircaloy-2 chips and fines imbedded in concrete in a storage drum. The non-concreted chips and fines are no longer present at the facility and will not be addressed. Also, an additional event scenario, large propane storage tanks explosion, has been analyzed, and a summary is provided in Section 3.2.2 under fire propagation.

3.2 Accident Analysis

Safety analyses (Johnson 1994) have been performed for the facility to establish a technical justification for the Interim Safety Basis (ISB) conclusion that the facility does not represent an undue risk to the public, employees, or the environment. In addition, the analysis provides a basis for the Facility Interim OSRs.

The accidents identified in Section 3.1.2 were analyzed (Johnson 1994), and those with the potential for a higher overall risk are listed below and summarized in this section:

- Seismic or other induced fire in uranium fuel storage building with fire protection system or Hanford Fire Department mitigation (Section 3.2.1),
- Seismic or other induced fire in uranium fuel storage building without mitigation (Section 3.2.1), and
- Multiple fuel stacking errors with introduction of optimum moderation (Section 3.2.3.1).

The additional event identified in Section 3.1.2, large propane storage tank fire, is discussed in Section 3.2.2, below.

The remaining bounded accident listed below, is discussed in detail in the analysis (Johnson 1994). No further discussion will be made of this bounded accident in this document.

- Ignition of HEPA filter containing uranium, Zircaloy-2, and beryllium metals and compounds during filter removal.

Based on the supporting analyses and the following discussion, it is concluded that storage and handling of uranium in the facility and cleanup and transition activities required for permanent closure and shutdown are within the HNF-PRO-704 Risk Guidelines. The 3712 Building fire, discussed below, is the bounding event for the facility.

3.2.1 3712 Building Fire

The bounding fire in the 3712 Building, which formerly contained 1122 MTU, was initially described in the accident safety analysis (Johnson 1994). This fire, initiated by a random fire or seismic event, presumes a four-hour fire resulting in a total uranium oxidation time of 8 hours with the fire department not responding. The total oxidation time is based on a peak temperature of 1093°C (2000°F) followed by cool-down taken from a standard fire profile taken from the Fire Protection Handbook (NFPA 1981). This event does not take credit for actuation of the building automatic fire alarm or sprinkler system or prompt fire fighting action by the Hanford Fire Department. The analysis used the combustible loading (wood, cardboard, plastics, etc.) associated with the specific 1122 MTU loading in the building at the time of the survey. The combustible loading provided a basis for calculating a fire load density (Btu/ft²) which established a fire duration (4 hours) and maximum temperature (approximately 1093°C.). The fire duration and temperature were then used to establish the fraction of the uranium inventory that was oxidized and subject to release.

3.2.1.1 Uranium Oxidation

Characteristics of uranium oxidation have been re-examined. For the purpose of this study, the median Airborne Release Fraction (ARF) and Respirable Fraction (RF) values from the DOE-HDBK-3010-94 (DOE 1994) are used to describe the burning of uranium, i.e., ARF = 1.0 E-04 and RF = 1.0. Selection of the median, rather than bounding, ARF and RF values is justified because any extended oxidation period would result in the buildup of an oxide layer that would tend to block the "escape" of newly reacted smoke particles.

The accident analysis for the facility (Johnson 1994) evaluated experimental data for metallic uranium oxidation involved in the fire temperatures that would be expected in a storage building fire and developed estimates for the time versus oxidation-temperature for complete oxidation of billets. The fire time-temperature profile (the ASTM standard time-temperature curve obtained from the Fire Protection Handbook, NFPA 1981) based on the combustible material loading shows that the temperature quickly reaches about 800°C in less than 30 minutes and then rises more slowly to reach 1000°C within 2 hours. Because extrapolation of the oxidation experiments indicates that billet oxidation would occur in approximately 170 hours at both 800°C and about 1000°C (Johnson 1994), that time is used to represent oxidation behavior up to 1000°C. Based on the fire temperature being at or above 1000°C from 2 hours to 4.5 hours, the oxidation time associated with the peak temperature (1093°C), i.e., 124 hours (Johnson 1994), is assigned to that time period. After 4.5 hours, the fire cools to 300°C in another 3.5 hours. Although no oxidation behavior for the lower temperature range was indicated in the references cited in the accident analysis (Johnson 1994), a 200-hour oxidation period is

conservatively applied to represent that temperature range because the oxidation rate is temperature dependent. Because of the mass of uranium associated with the postulated fire, it is believed that buildup of oxide "ash" would inhibit the oxidation process somewhat. Thus the fraction of billets oxidized during the fire would be conservatively represented by:

$$2 \text{ hr}/170 \text{ hr} + 2.5 \text{ hr}/124 \text{ hr} + 3.5 \text{ hr}/200 \text{ hr} = 0.0494.$$

Treating oxidation of the clad fuel as though it were unclad billets is conservatively valid because a) the Zircaloy-2 cladding forms a protective adherent oxide coating that resists further oxidation (Johnson 1994), and b) although the ends of the unfinished fuel stored in the 3716 Building have no cladding, all fuel components are substantially longer than the diameter of the billets by at least a factor of 2. Furthermore, comparison of the ratios of exposed uranium surface area to uranium mass for billets and the shortest fuel assembly (assuming that the end caps fall off during the fire because the braze melts) yields values of 47 cm²/kg and 13 cm²/kg for billets and fuel assemblies, respectively. Thus, billets have more "opportunity" for oxidation. Although Zircaloy-2 is designed primarily for nuclear reactor components, its oxidation resistance has been reported to be such that after approximately 100 hours in air at 650°C., an adherent protective coating measuring up to 300µm thick is formed (Sinha, et al 1987).

The maximum inventory of any fuel storage building is found in the 3712 Building, which holds 673.2 MTU (represented as 675 MTU) composed of 24 MTU billets, and essentially all of the remainder as clad fuel assemblies. Although the Zircaloy-2 cladding associated with the fuel assemblies should provide oxidation protection for the underlying uranium (Johnson 1994), the assemblies are conservatively treated as though they were billets and included in the overall inventory potentially at risk. No other FSS storage building exceeds this quantity of assemblies. The only other storage building containing billets is the 303-G Building with an inventory of slightly less than 210 MTU billets.

3.2.1.2 Radiological Consequences

Inserting these revised values for ARF, RF, and fraction billet oxidation into the equations developed in the initial hazard classification analysis, which include appropriate dose conversion factors derived from GENII computer code calculations (Huang 1999 and Johnson 1994) that predict potential radiological dose consequences provides the following results:

$$\text{Dose} = \text{Inv} \times \text{OF} \times \text{ARF} \times \text{RF} \times \text{DLF}$$

Where Inv = 3712 Building Inventory

OF = Oxidation Fraction

ARF = Airborne Release Fraction

RF = Respirable Fraction

DCF = Dose Conversion Fraction

$$\text{Dose}_{(\text{onsite})} = 675 \text{ MTU} \times 0.0494 \times 1.0 \text{ E-}04 \times 1.0 \times 1.5 \text{ E+}03 \text{ rem/MTU} = 5.0 \text{ rem}$$

$$\text{Dose}_{(\text{offsite})} = 675 \text{ MTU} \times 0.0494 \times 1.0 \text{ E-}04 \times 1.0 \times 9.6 \text{ E+}01 \text{ rem/MTU} = 0.32 \text{ rem}$$

3.2.1.3 Toxicological Consequences

Toxicological concentrations were calculated similarly using the methodology of the hazard classification analysis (Huang 1999) that incorporated values for inventory, ARF, RF, fraction inventory oxidized, time, and dispersion coefficient (χ/Q). Terms for the fraction of the inventory oxidized (0.25 hr/124 hr) and oxidation time (0.25 hr) were selected to focus on the highest temperature portion of the fire temperature profile curve, i.e., above 1000°C, to obtain the maximum concentrations. The 0.25 oxidation period is used in accordance with HNF-PRO-704, which requires the peak 15-minute average concentration be used.

$$\text{Conc} = \text{Inv} \times \text{ARF} \times \text{RF} \times 1/t \times \chi/Q$$

Where:

Inv	=	3712 Building Inventory
ARF	=	Airborne Release Fraction
RF	=	Respirable Fraction
1/t	=	Reciprocal Time (sec ⁻¹)
χ/Q	=	Dispersion Coefficient (sec/m ³)

Thus for uranium, calculated concentrations are:

$$\begin{aligned} \text{Conc}_{(\text{onsite})} &= 675 \text{ MTU} \times \frac{10^9 \text{ mg}}{\text{MT}} \times \frac{0.25 \text{ hr}}{124 \text{ hr}} \times 1 \text{ E-}04 \times \frac{1}{(0.25 \text{ hr})(3600 \text{ s/hr})} \times 3.4 \text{ E-}02 \text{ s/m}^3 \\ &= 5.1 \text{ mg U/m}^3 \end{aligned}$$

$$\begin{aligned} \text{Conc}_{(\text{offsite})} &= 675 \text{ MTU} \times \frac{10^9 \text{ mg}}{\text{MT}} \times \frac{0.25 \text{ hr}}{124 \text{ hr}} \times 1 \text{ E-}04 \times \frac{1}{(0.25 \text{ hr})(3600 \text{ s/hr})} \times 2.3 \text{ E-}03 \text{ s/m}^3 \\ &= 0.35 \text{ mg U/m}^3 \end{aligned}$$

Beryllium (Be) concentrations were calculated similarly making adjustment for the Be subject to oxidation. A significant adjustment in the Be inventory was made to reflect the removal of nearly 6500 kg (14,293 lbs) of braze rings, which contain 5% Be, from the 3712 Building. The current braze ring inventory in this building is limited to the 3630 kg (8000 lbs) conservatively estimated to be associated with the finished fuel assemblies. Because this Zr-Be-Sn alloy would be expected to exhibit similar oxidation resistance as Zr (to near the alloy melting point of approximately 950°C.) (Lustman and Kerze 1955), and the braze ring is protected by the Zircaloy-2 end cap, no more than 10% of the braze ring is conservatively presumed to oxidize during the 15-minute period defining the peak concentration to calculate the maximum possible quantity of airborne Be. The ARF and RF values assigned previously to burning U, i.e., 1.0 E-04 and 1.0, respectively, were applied to the Be. Thus for Be, calculated concentrations are:

$$\begin{aligned} \text{Conc}_{(\text{onsite})} &= 3630 \text{ kg} \times \frac{10^9 \mu\text{g}}{\text{kg}} \times \frac{5\% \text{ Be}}{\text{braze ring}} \times 0.1 \times 1 \text{ E-}04 \times \frac{1}{(0.25 \text{ hr})(3600 \text{ s/hr})} \times 3.4 \text{ E-}02 \text{ s/m}^3 \\ &= 68.6 \mu\text{g Be/m}^3 \end{aligned}$$

$$\text{Conc}_{(\text{offsite})} = 3630 \text{ kg} \times \frac{10^9 \mu\text{g}}{\text{kg}} \times \frac{5\% \text{ Be}}{\text{braze ring}} \times 0.1 \times 1 \text{ E-04} \times \frac{1}{(0.25 \text{ hr})(3600 \text{ s/hr})} \times 2.3 \text{ E-03 s/m}^3$$

$$= 4.6 \mu\text{g Be/m}^3$$

3.2.1.4 Fire Risk and Controls

Comparison of these unmitigated consequences with the HNF-PRO-704 REGs is shown in Figure 3.2.1-1. REGs for both “unlikely” and “extremely unlikely” events are presented for comparison because the probability of an unmitigated fire is essentially on the cusp of probabilities separating these event categories. [The random fire probability is conservatively estimated at 1.0 E-04/yr, the seismic-induced fire probability is 1.1 E-04/yr (see Figures 3.2.3.2-1 and -2)]. Note that for “unlikely” events both the uranium and beryllium toxicological REGs for onsite exposure are exceeded with predicted radiological doses being less than guideline values. For “extremely unlikely” events, all predicted radiological doses and toxicological concentrations are less than REG values.

Table 3.2.1-1. Risk Evaluation Guidelines Comparison with Maximum Potential Consequences

CRITERIA OR EVENT	RADIOLOGICAL CONSEQUENCES		TOXICOLOGICAL CONSEQUENCES	
	Onsite ^a	Offsite ^f	Onsite ^a	Offsite ^f
Unlikely Events (HNF-PRO-704 Guidelines)	250 mSv (25 rem) EDE	50 mSv (5 rem) EDE ^a	TEEL-2 Be: 25 $\mu\text{g}/\text{m}^3$ U: 0.6 mg/m^3	TEEL-1 Be: 5 $\mu\text{g}/\text{m}^3$ U: 0.6 mg/m^3
Extremely Unlikely Events (HNF-PRO-704 Guidelines)	1 Sv (100 rem) EDE	250 mSv (25 rem) EDE	TEEL-3 Be: 100 $\mu\text{g}/\text{m}^3$ U: 10.0 mg/m^3	TEEL-2 Be: 25 $\mu\text{g}/\text{m}^3$ U: 0.6 mg/m^3
Maximum Release (8 hr fire in 3712 Building)	50 mSv (5.0 rem) EDE	3.2 mSv (320 mrem)	Be: 68 $\mu\text{g}/\text{m}^3$ U: 5.1 mg/m^3	

*Probability of unmitigated uranium storage building fire is “unlikely”.

a EDE - Effective Dose Equivalent (from HNF-PRO-704).

b TEEL-1 - Temporary Emergency Exposure Level No. 1 (from Craig 1998).

c TEEL-2 - Temporary Emergency Exposure Level No. 2 (from Craig 1998).

d TEEL-3 - Temporary Emergency Exposure Level No. 3 (from Craig 1998).

e Onsite – 100 m East.

f Offsite – 490 m East at adjacent river bank.

The primary control used to limit the predicted uranium toxicological dose for “unlikely” events is to ensure the availability of the fire protection system. Although the REGs are challenged, there are sufficient administrative controls to not designate the fire protection systems, or any portion of them, as Safety Significant. Despite using “off-the-shelf” commercial-grade fire protection system components, all such components are designed to the Underwriters Label and/or Factory Mutual consensus standards and possess their endorsements.

Also, testing and maintenance of these systems is in accordance with the NFPA requirements as embodied in HNF-PRO-351, *Fire Protection System Testing/Inspection and Maintenance*. A qualified fire protection engineer performs independent verification of component identification following fire suppression system modification. Furthermore, independent verification of valve positions following maintenance is performed by FSS Project personnel. Benefit of the fire protection systems is provided by the inherent reliability of the purchased components, the disciplined testing/inspection and maintenance performed, and the independent verifications performed for component installation and valve positions. Designation of the fire protection systems as Safety Significant could actually result in decreased system availability if properly pedigreed replacement components were unavailable.

A secondary control is established on the uranium and combustible material inventories of the fuel storage buildings to limit potential consequences should the fire suppression systems fail. Because the probability of an uncontrolled fire resulting from fire suppression system failure is 2.75×10^{-5} for the seismic-induced fire (see Figure 3.2.3.2-2), or extremely unlikely, the inventory control should be such that the REG values for extremely unlikely events cannot be exceeded. For the random fire scenario, the uncontrolled fire probability is not credible (see Figure 3.2.3.2-1). For the seismic-induced fire scenario, the uncontrolled fire probability is "extremely unlikely" (see Figure 3.2.3.2-2). Thus, the REG values associated with "extremely unlikely" events, i.e., 1 Sv (100 rem) and TEEL-3 for the onsite receptor, and 250 mSv (25 rem) and TEEL-2 for the site boundary receptor, are the basis for the inventory control.

3.2.2 Large Propane Storage Tank Fire

A metals fabricator utilizes the large metal extrusion press located in the north end of the 313 Building as a private industry venture. Liquefied petroleum gas (LPG) is used to heat the building and also to provide fuel for the aging/annealing oven. A review of the propane tank storage and operations indicated that three propane related events warranted evaluations (1) a Boiling Liquid, Expanding Vapor Explosion (BLEVE), (2) a propane leak and explosion/deflagration in the 313 Building, and (3) uncontrolled venting at a tank resulting in a release of combustible gas. An analysis was prepared to assess the impact of the propane tank accident events on the 3712 and 3716 fuel storage buildings (Brehm 1997).

The potential consequences and/or probability of a BLEVE at one of the two 1000-gallon propane supply tank or a 3000-gallon propane delivery truck tank at the north end of the 313 Building were evaluated as to the potential for either event to initiate a fire in either or both the 3712 or 3716 uranium fuel storage buildings. In evaluating data on BLEVEs published by the National Fire Protection Association, it was concluded that an intense heat source is necessary to initiate a BLEVE, such as a vehicle fire during filling of the tank. Although a 3712 Building fire initiated by a propane delivery truck BLEVE is credible [7.8×10^{-6} /yr, based on historical Hanford Site vehicle fire data and consideration of the angle subtended by the building foot print (Brehm, et al 1997)], no additional combustible material would be added to the facility (fire is presumed to result from hot sections of the exploding tank impacting the building). Thus, its consequences are bounded by the fire initiated by sources from within the building (Section 3.2.1). The probability of fires being initiated in both the 3712 and 3716 Buildings by a delivery truck fire and subsequent BLEVE of the delivery truck propane tank is 3.2×10^{-7} fires/year (Brehm 1997).

which is not credible. Similar evaluation of a storage tank BLEVE resulting from upsets during fuel delivery resulted in a probability of $1.6\text{E-}08$ fires/yr (Brehm 1997) simultaneously in the 3712 and 3716 Buildings. This event is also not credible.

The second accident evaluated was that of a slow propane leak inside the 313-North Building during a non-operational period. Results of this analysis indicate that a leak would have to go undetected for at least 10 hours to produce an explosion large enough to heavily damage the 3712 Building, while the 3716 Building would suffer only minimal damage. The potential for a fire being initiated in the 3712 Building as a result of a gas explosion is very small, since the flash would be of short duration. Fire initiation in the 3716 Building is not credible because of the minimal damage credited. Actual damage to either building would be considerably less than predicted by the analysis (Brehm 1997) because the presence of the 313 North Building was not considered. That building structure would absorb a substantial portion of the explosive energy, thereby reducing the damage to the 3712 and 3716 Buildings.

Evaluation of the third potential event, ignition of a venting liquefied petroleum gas storage tank, concluded that there are no hazardous consequences.

One additional LPG storage tank has been reviewed: an underground tank north of the 3712 Building and approximately 1.5 m south of the 3720 Building owned by PNNL. Inspection of this tank shows it to be disconnected. The tank has not been in use for several years and is not scheduled to be placed in service.

3.2.3 Criticality Analysis

3.2.3.1 Criticality Accident Scenarios

All fissionable materials (feed material, i.e., billets, fuel components, fuel assemblies, and scrap) are handled and stored according to Criticality Prevention Specifications (CPS) that ensure at least two unlikely and independent contingencies must occur before criticality is possible. The CPS limits consider the specific enrichment and physical characteristic of each type of fissionable material in the facility. For handling, the quantity of fissionable material is limited to the hemispherical safe mass (i.e., half the minimum mass corresponding to $k_{\text{eff}} = 0.98$). For storage, the CPS limits are based on areal density and potential moderation/reflection under accident conditions.

Use of the hemispherical safe mass limit for handling activities addresses all handling and packaging accident scenarios. The hemispherical safe mass values assume optimum spacing, moderation, and full reflection to obtain true minimum values (Schwinkendorf 1995). These conditions could conceivably be achieved by a fire that destroyed the container and resulting flooding from fire suppression efforts. Even under these conditions, the configuration is safe unless it is more than double batched. Because moderation and reflection are necessary to achieve a criticality, no human error or combination of human errors by themselves, i.e., CPS noncompliance, can result in criticality.

Storage of N Reactor fuel and feed materials has been analyzed and found to be subcritical under all credible accident scenarios (Schwinkendorf 1995). All fuel storage arrays are substantially subcritical if mis-stacked, even double stacked. Similarly, all fuel storage arrays are substantially subcritical if optimally moderated. Combining contingencies of mis-stacking and introduction of optimum moderation still produces configurations with substantial margins of subcriticality.

Criticality is possible only if at least three contingencies are exceeded (Schwinkendorf 1995). Criticality requires the following:

- a) Mis-stacking: The array of fuel storage boxes is significantly mis-stacked, i.e., to where it becomes the equivalent of an infinite array of the incorrect stacking. This contingency also represents the inadvertent placement of Mark IA fuel in storage array locations designated for Mark IV fuel.
- b) Reconfiguration: The array of fuel assemblies within the storage boxes collapses, resulting in a lattice of fuel assemblies that do not touch, but are in a lattice providing optimum spacing. A fire that destroyed the storage boxes could conceivably approximate this.
- c) Moderation: The collapsed array of fuel assemblies is moderated. Presumably, fire suppression efforts could approximate this condition.
- d) Reflection: The moderated collapsed array is reflected. This could be achieved by water that completely covered the collapsed array. This water could also result from fire suppression efforts. Blockage of the facility drains, allowing sufficient depth to accumulate, represents the third contingency.

The unlikely contingencies are 1) mis-stacking, 2) a fire that consumed the storage containers (collapsing the array) and provided moderation through mitigation efforts, and 3) blocking of the storage building drains that allowed sufficient water accumulation to completely cover the array and provide the necessary reflection.

The Mark IA fuel assembly (the most reactive fuel assembly in FSS which consists of a 1.25% enriched "outer" combined with a 0.95% enriched "inner") bare slab height for $k_{\text{eff}} = 0.98$, i.e., the value for the collapsed and optimally moderated but unreflected fuel assemblies, is 17.3 inches. The height of the optimally spaced Mark IA slab array resulting from collapsed mis-stacked storage boxes (three high) is 13.8 inches, which is less than the height corresponding to $k_{\text{eff}} = 0.98$. (A bare slab height of 18.2 inches corresponds to $k_{\text{eff}} = 1.0$) For Mark IV fuel assemblies, a bare slab height of 23.4 inches corresponds to $k_{\text{eff}} = 0.98$. The height of the optimally spaced Mark IV slab array resulting from collapsing a mis-stacked array (four high for Mark IV) is 23.0 inches. Except for essentially infinite arrays, moderated and reflected configurations of fuel assembly components are less reactive than identical configurations of fuel assemblies. Thus, the accident conditions involving unfinished fuel are bounded by the fuel assembly analyses.

Conservatisms in the criticality calculations include:

- a) Mis-stacking must involve many adjacent stacks of storage boxes. Partial mis-stacking, e.g., four out of five, results in an array well within the $k_{eff} = 0.98$ criterion.
- b) No credit is taken for the neutron absorbing characteristics of the storage box metal fasteners and impurities in the wooden storage boxes.

3.2.3.2 Criticality Probability

Although criticality is possible as described above, it is not credible. Probabilities of necessary contingencies are discussed below. Although the focus of the probability analysis is on the storage mode (Kelly 1995), it also applies to the handling mode because criticality is impossible unless mishandling initially creates an ideal configuration that is subsequently subject to fire, moderation, and reflection. A facility-specific fissionable material handling procedure is in place that requires one-over-one verification that essential CPS requirements are maintained.

Mis-stacking. Criticality Prevention Specification limits on fuel storage box stack heights preclude accumulation of sufficient fissionable material that could theoretically become critical following potential subsequent events. (The most reactive Mark IA fuel assemblies are restricted to two-high stacks of storage boxes. Mark IV fuel assembly storage boxes are limited to three-high stacks. One outer fuel element may be substituted in the place of a single fuel assembly. Labeling of all containers is thoroughly verified.) Many adjacent stacks must be affected to approximate the equivalent of an infinite array. At a minimum, this corresponds to a four-by-four array that would require at least sixteen errors. All fuel movements are supervised to ensure that essential requirements of the CPS (stacking height, moving less than the hemispherical safe mass quantity, spacing and criticality drain availability) are maintained; unauthorized fuel movement is prevented by the storage buildings being locked. Periodic inspections of fuel storage facilities are performed to assure compliance with stacking requirements. Although a probability of $1.0 \text{ E-}04$ (Kelly 1995) was assigned to this contingency based on rigorous oversight associated with all fuel movements, the more conservative value of $1.0 \text{ E-}02$ is adopted to allow for unforeseen distractions that could accompany fuel disposition.

Reconfiguration. Removal of the storage boxes and collapse of the fuel assemblies could result only as a consequence of a fire. Historical review of the entire facility, including fuel manufacturing operations, for the last 25 years resulted in an annual fire probability of $1.6 \text{ E-}01$. This probability is overly conservative considering that fuel fabrication operations have ceased (previous facility fires resulted mostly from operations involving uranium chips and fines) and energy sources capable of initiating a fire have been substantially reduced. Data received from the U.S. Fire Administration National Fire Data Center for the 1995 – 1997 time period indicates a fire incidence rate of $8.1 \text{ E-}06$ fires/yr for military storage buildings related to national defense (Gerstner 1999). “Derating” this probability to $1.0 \text{ E-}04$, i.e., increasing the fire probability by more than an order of magnitude assures applicability of the revised frequency to the fuel storage buildings for current and anticipated activities, including fuel disposition.

A seismic induced fire has a smaller probability ($1.1 \text{ E-}04$) because of the combination of the probability of an earthquake greater than UBC design criteria (Kelly 1995) and conservative engineering judgement regarding the probability of consequent fire reaching the fuel storage boxes. This judgement was based on personal experience of living in California earthquake zones where natural gas was the dominate heating fuel (Kelly 1995). Despite minimal energy sources existing in the storage buildings that could initiate a fire, the Kelly 1995 estimate of $1.0 \text{ E-}02$ for the probability of fire initiation was reduced by an order of magnitude to account for the anecdotal nature of that value.

For reconfiguration to occur, fire control efforts must fail. Because subsequent moderation is necessary for a criticality to occur, the sprinklers must activate somewhere in the storage building to provide water. Probability of the sprinklers failing to control the fire is estimated at $1.0 \text{ E-}02$ based on test data and probability studies (Kelly 1995).

Although fuel assembly collapse into a lattice with near optimum separation is improbable, a probability of unity was assumed for that aspect of reconfiguration because of the difficulty of assigning a specific reconfiguration mechanism.

Moderation. Fire mitigation efforts could add sufficient water to moderate the collapsed array. This corresponds to a water depth of at least 17.3 inches. Because moderation is necessary before criticality can occur, the sprinklers must activate somewhere within the storage building to provide water. Probability of the sprinklers actuating but failing to control the fire is estimated at $1.0 \text{ E-}02$. HFD activities will not contribute to moderation because their presence would preclude water accumulation. In fact, moderation cannot occur unless the HFD fails to respond and open the storage building door. The HFD must open the storage building door to fight the fire because the hutments (303-A, 303-B, and 303-G) do not have windows and the few windows in the 3712 and 3716 Buildings are covered with heavy screens. The most straightforward path for the HFD to the fire would be to enter the building through the door. If the 3712 Building fire were confined to the north end, the HFD may choose to also cut through the roll-up doors to gain entry, which would provide another water outflow path. Kelly 1995 assigned a HFD failure-to-respond probability of $1.0 \text{ E-}04$ based on failure rates for fire detection and alarm systems and consideration of fire truck accident on the way to fighting the fire. Considering the age of fire detection and alarm systems in these buildings and reluctance to quantify performance expectations for the HFD, this value is discounted to $1.0 \text{ E-}01$ to ensure conservatism. For the seismic induced fire scenario, the probability is 0.5 to account for the many demands that would be made on the HFD following a seismic event and because of the likelihood of the fire suppression system water supply breaking in the vicinity of the fire.

Reflection. Adding additional water to provide reflection is necessary to achieve criticality. Drainage of fire suppression water is assured by multiple built-in floor level drains or flexible baffles at the bottom of large roll-up doors designed to drain that quantity of water that could be released by credible fire suppression efforts or broken water supply lines. Recognizing that the drains are regularly inspected to assure availability, probabilities of $1.0 \text{ E-}3$ for the random fire event and $5.0 \text{ E-}1$ for the seismic induced fire were assigned by Kelly 1995. Probability of drain failure is more likely following a seismic event because of the increased quantity of debris that could interfere with drain function. However, since the Kelly evaluation

was completed, consideration of drain clogging by plastic pieces swept from bagged fuel assemblies and/or components or by other debris has resulted in increasing the probability of drain failure to $5.0 \text{ E-}01$ for both scenarios.

Overall Criticality Probability. Overall probability for criticality resulting from a random fire is $5.0 \text{ E-}10$ (see Figure 3.2.3.2 -1). The corresponding probability for a criticality resulting from a seismic induced fire is $1.4 \text{ E-}07$ (see Figure 3.2.3.2-2). Both values are substantially less than $1.0 \text{ E-}6$, which is the threshold for credibility. No other scenario is postulated that could result in criticality. Therefore, per DOE 5480.24, a criticality detection and alarm system (CAS) is not required.

Figure 3.2.3.2-1. Random Fire Criticality Event Tree

Figure 3.2.3.2-2. Seismic Induced Fire Criticality Event Tree

3.2.4 Aircraft Crash Analysis

Although aircraft crash into the facility was not included in the original hazard analysis (Johnson and Brehm, 1994), consideration of such events is shown below. An examination of commercial, military, and pesticide/herbicide overflights of the Multi-function Waste Tank Facility (MWTF) (Muhlestein 1994) determined that aircraft crash into that facility was not credible ($< 1.0 \text{ E-06/yr}$). This conclusion is conservative with respect to the fuel storage buildings because the MWTF area is substantially larger (3.88 E+05 m^2 for the MWTF vs 9.03 E+02 m^2 for the 3712 Building (the largest fuel storage building)). Thus, the probability for an aircraft crash into that facility would be expected to be less by the ratio of areas, i.e., 2.3 E-03 . Then, the probability of commercial, military, or pesticide/herbicide aircraft crash into five fuel storage buildings would be less than 1.2 E-08/yr , or not credible.

The probability of a helicopter malfunction and subsequent crash into the 3712 Building during an overflight for the purpose of obtaining radiological surveys (presumed to be annually) was considered per the methodology of DOE-STD-3014-96, Accident Analysis for Aircraft Crash into Hazardous Facilities (DOE 1996). This standard provides a crash rate of 2.5 E-05 crashes per flight, which when used in conjunction with a formula provided by the standard for calculating the effective area of the facility for impact from a helicopter (1.84 E+04 ft^2), results in an estimated annual probability of 1.7 E-08 for a helicopter crash into the 3712 Building (assuming two flights per year to allow for confirmatory measurements to be made and the total flight path from its takeoff/landing site covers at least a square mile of potential affected area). Thus, the crash of a helicopter into any of the fuel storage buildings while performing radiological surveys is judged not to be credible.

Intuitively, the addition of helicopter flights over the Hanford Site for emergency medical evacuation should not have any higher probability for crash into the facility than the helicopter flights for radiological surveys. Procedures for these flights prohibit flight over major Hanford facilities. Pilots receive Hanford-specific training that defines pre-established landing zones and approach paths to avoid facility overflight. Definitive "no-fly zones" are established. Depending on the location and/or patient condition, the responding helicopter may land on a Hanford roadway near the incident site. Helicopter flights will be infrequent since emergency helicopter service will be employed only to preserve human life. In most instances, ground ambulance service will suffice, particularly because the 300 Area is relatively close to a local hospital which makes travel time by ground nearly equivalent to flight time.

The DOE Standard (DOE 1996) also provides for calculating the probability of a general aircraft crash into the facility. The Standard provides a general aircraft annual crash frequency of $1.0 \text{ E-04 crashes/mi}^2$ for the Hanford Site, which when used in conjunction with the formula to calculate the effective area of the 3712 Building for impact from general aircraft (5.57 E+04 ft^2), results in an estimated annual probability of 2.0 E-07 for a general aircraft crash into the 3712 Building. Even if the other four fuel storage buildings were as large as the 3712 Building, a general aircraft crash into any of them would not be credible.

3.2.5 Risks

The consequences of accidents and events summarized in Sections 3.2.1 – 3.2.4 are based on analyses reflecting the current facility configuration and follow-on transition and shutdown activities, including uranium disposition. The accident dose consequences analysis was made using site-specific meteorology, and the applicable Hanford Environmental Dose Overview Panel (HEDOP) accepted GENII analysis code/version. Those results (Huang 1999 and Johnson 1994) have been approved by an independent HEDOP reviewer. Extensions of those analyses presented in this document have undergone formal independent peer review. Criticality calculations have been performed using modern computer codes that comply with Software Quality Assurance (SQA) requirements. Therefore, the consequences of the accidents and events are considered valid. Based on the supporting analyses and the evaluations presented in Sections 3.2.1 – 3.2.4 above, it is concluded that current and future facility operations bound by this ISB are well within the Risk Guidelines of HNF-PRO-704.

3.3 Hazard Controls

3.3.1 Safety Class Structures, Systems, and Components

Accidents with significant dose consequences have been analyzed (Johnson 1994) and re-evaluated (see Sections 3.2.1 – 3.2.4). The fire suppression components of the storage building fire protection systems are not designated Safety Significant. The probability of an uncontrolled uranium storage building fire is no more frequent than “extremely unlikely” because equivalent system surveillance, administrative control, and oversight is provided to assure reliability and effectiveness. Additionally, none of the postulated accident consequences exceed the Safety Class criteria of HNF-PRO-704.

3.3.2 Design Features

Configuration features that are directed at further reducing the probability of a criticality and reducing dose consequences associated with accidents are described below.

Facility Water Drainage. (See Figures 2.2.2-2, 2.2.2-3, and 2.2.2-4). The fuel storage buildings contain features that would drain water to the outside ground and prevent accumulation of sufficient water to provide reflection of the reconfigured fuel assemblies resulting from a fire. Because this reflection represents a third contingency necessary for criticality (Schwinkendorf 1995), and the probability of criticality is essentially incredible without taking credit for the drains (Kelly 1995 and see figures 3.2.3.2-1 & -2), these configuration features are not considered to be Safety Class or Safety Significant items, but do provide additional contingency.

3.3.3 Facility Degradation

The facility structures, systems, components, and, particularly, some of the building roofs, have suffered some degradation. Failure of the structures and components has the potential for changing the fuel spacing, impacting the building drainage ports, and/or failing the fire protection system. The structures and components (e.g., electrical, etc.) are not Safety Class or Safety Significant for the following reasons:

- The criticality safety analysis considers optimum moderation (the potential result of structure failure damaging the fire protection system causing introduction of water, and plugging the drainage ports preventing escape of the water). However, this scenario would not consume the storage boxes to permit the reconfiguration necessary for criticality.
- The fire criticality probability analysis considers the probability of introduction of water, prevention of escape of the water, and changes in fuel storage geometry with the systems and structures not being Safety Class or Safety Significant. This analysis does depend on the availability of the fire protection systems and Hanford Fire Department response, however.
- The facilities do not have confinement systems. The structures are essentially open to the atmosphere, and their failure would not significantly change the ability to contain releases. The accident safety analysis does not take credit for confinement.
- Facility structural failure that damaged its fire protection system would initiate a fire alarm or a trouble alarm, depending on the nature of the fire protection system failure. The HFD promptly responds to all fire alarms; response to trouble alarms could be delayed several hours. Compensatory action would be implemented immediately upon recognition of system impairment.

Facility construction and the building layouts are included in Section 2.2.2.

3.3.4 Control and/or Mitigation of Structure, System, and Component (SSC) Deficiencies

Although not designated as Safety Significant SSC, the storage building fire protection systems include alarms that annunciate upon water flow or system failure. The site fire protection system monitoring system features automatic trouble alarm annunciation if a particular facility system fails to “check in” on schedule (systems are designed to “check in” every 24 hours).

3.3.5 Administrative Controls

This ISB defines the safety envelope for the remainder of the facility mission until turnover for D&D.

The Interim OSRs for operation for the facility define acceptable conditions, safe boundaries, bases thereof, and management or administrative controls required to ensure safe fuel storage and transition activities of the facility. The scope of the Interim OSRs is limited to maintaining the safety envelope as defined by this ISB.

The format and content of the Interim OSRs are based on DOE Order 5480.22 on TSRs. The Interim OSRs and appendices constitute an agreement or contract between DOE and BWHC regarding the safe operation of the facility. As such, the Interim OSRs cannot be changed without the approval of the DOE Program Secretarial Officer (PSO), or designee. The scope of the Interim OSRs is based on this facility ISB document.

Administrative controls that provide assurance of maintaining the safety envelope are as follows:

- Limiting fuel handling to quantities less than the minimum hemispherical safe mass quantities. Anticipated uranium repackaging activities associated with uranium disposition are subject to this requirement.
- Maintaining compliance with Criticality Prevention Specifications, including performing periodic surveillance of uranium storage building drain systems.
- Maintaining control of storage building combustible material and uranium inventories.
- Maintaining the automatic fire protection systems for the uranium fuel material storage buildings to HNF-PRO-351, Fire Protection System Testing/Inspecting and Maintenance Frequencies, that incorporates NFPA requirements subject to DOE exemptions.
- Performing independent verification of component identification following fire suppression system modification and valve positions following fire suppression system maintenance.

3.3.5.1 Institutional Safety Programs

Safety programs are identified in Section 4.0.

3.4 Summary

It is concluded that the risk associated with the current and planned operational mode of the facility, (uranium storage, uranium disposition, cleanup, and transition activities, etc.) are within extremely unlikely Risk Evaluation Guidelines (REG) of HNF-PRO-704. The uranium fuel storage buildings (303-A, 303-B, 303-G, 3712, and 3716) are assigned a hazard classification of Category 3, since the inventory available for release is less than the identified Category 2 threshold quantities (TQs), although their basic inventory exceeds category 2 TQs. The dose and toxicological consequences for the maximum credible fire have been analyzed using current

Hanford accepted methods. Although the REGs for “unlikely” events are challenged, there are adequate administrative controls to not designate the fire protection systems, or any portion of them, as Safety Significant. These controls are designed to ensure an event probability of “extremely unlikely”.

It is also concluded that because the probability of accidental criticality is not credible, a criticality alarm system (CAS) is not required as allowed by DOE Order 5480.24.

4.0 HANFORD GENERIC AND FACILITY PROGRAMS

The Project Hanford Management System assures operation of the facility in a configuration that supports the defined safety envelope by addressing the following:

- Configuration Management
- Occurrence Reporting
- Criticality Safety
- Unreviewed Safety Question Screening and Evaluation

Additional Project Hanford Management System Procedures assure maintenance of the facility in a configuration that supports worker safety by addressing the following:

- Radiation Protection
- As Low As Reasonably Achievable (ALARA)
- Occupational and Industrial Safety
- Fire Protection
- Industrial Hygiene
- Training
- Radioactive Waste Management
- Quality Assurance
- Conduct of Operations
- Emergency Planning
- Environmental Protection
- Maintenance

The Project Hanford safety requirement, corresponding DOE Orders and Titles, and the applicable Project Hanford Procedures are contained in Table 4.0-1, columns 1, 2, and 3.

Included in the institutional safety program are controls to detect and guard against toxicological threats inherent in the FSS. In particular, the low-enriched uranium and beryllium present specific risks. Bioassay and medical monitoring is conducted for personnel whose work assignments may entail potential exposure to these elements and their compounds.

The facility-specific safety and control programs are included in FSP-FSS-5-35, Fuels Supply Operations Control Manual. The fourth column of Table 4.0-1 contains facility specific procedures and controls that are fully or partially responsive to the institutional control or safety requirement, DOE Order and title, and applicable Project Hanford Management Procedure(s) listed in the first three columns. The degree of responsiveness is based on facility specific needs.

The site Integrated Environment, Safety and Health Management System (ISMS) is used to integrate environmental, safety, and health standards into work management and practices at all levels of work planning and execution to protect workers, public, and the environment.

Table 4.0-1. Identification of Institutional Control or Safety Requirements, DOE Orders and Titles, Project Hanford Procedures and Fuel Supply Shutdown-Specific Implementing Documentation.

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT	DOE ORDER/TITLE	APPLICABLE PROJECT HANFORD PROCEDURES	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES
Radiation Protection	<p>5400.5, <u>Radiation Protection of the Public and the Environment</u></p> <p>5484.4, <u>Environmental Protection, Safety, and Health Protection Standards</u></p> <p>10 CFR 835, <u>Occupation Radiation Protection</u></p>	<p>HSRCM-1, <u>Hanford Site Radiological Control Manual</u></p> <p>HNPF-PRO-379, External Dosimetry Program</p> <p>HNPF-PRO-380, Internal Dosimetry Program</p> <p>HNPF-PRO-331, Workplace Air Monitoring</p> <p>HNPF-PRO-329, Radiological Training</p> <p>HNPF-PRO-326, Contamination Area Controls</p> <p>HNPF-PRO-327, Fixed Contamination Areas</p> <p>HNPF-PRO-377, HEPA Filtered Vacuum Cleaners and Portable Ventilation Systems</p> <p>HNPF-PRO-319, Radiation Protection Self Assessments</p> <p>HNPF-PRO-453, Spill and Release Reporting</p> <p>HNPF-PRO-459, Environmental Training</p> <p>HNPF-PRO-462, Pollution Prevention</p>	<p>The facility operations conform to the Hanford Site Radiological Control Program manual. Facility-specific Radiation Work Permits (RWP) that conform to the HSRCM requirements are prepared and followed. HNF-IP-1277, 300 Area Radiological Control Procedures, defines the radiological program for the River Corridor Project.</p>

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT	DOE ORDER/TITLE	APPLICABLE PROJECT HANFORD PROCEDURES	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES
		HNF-PRO-455, Solid Waste Management HNF-PRO-328, Personnel Monitoring HNF-PRO-388, Radiological Problem Reports HNF-PRO-423, Radiological Work Permit HNF-PRO-435, Required Radiological Surveillances HNF-PRO-632, GM Portable Survey Instrument HNF-PRO-686, Radiological Control Hold Points HNF-PRO-1526, Implementing Radiation Protection Technical Procedures HNF-PRO-1892, Documentation of Radiological surveys.	
ALARA	5480.11, <u>Radiation Protection for Occupational Workers</u>	HSRCM-1, Hanford Site Radiological Control Manual HNF-PRO-159, ALARA Program Description HNF-PRO-1629, ALARA Administrative Control Levels HNF-PRO-1621, ALARA Decision- Making Methods HNF-PRO-1618, ALARA Management Commitment & Policy HNF-PRO-1619, ALARA	The facility operation conforms to the HSRCM. No additional facility-specific procedures are considered necessary. An ALARA point of contact has been designated. HNF-IP-1277, 300 Area Radiological Control Procedures, defines the radiological program for the River Corridor Project.

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT	DOE ORDER/TITLE	APPLICABLE PROJECT HANFORD PROCEDURES	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES
		<p>Organization & Responsibilities</p> <p>HNF-PRO-1633, ALARA Program</p> <p>Records</p> <p>HNF-PRO-1620, ALARA Program</p> <p>Scope</p> <p>HNF-PRO-1631, ALARA Training</p>	
Occupational and Industrial Safety	<p>5483.1a, <u>Occupational Safety and Health Program for DOE Contractor Employees at Government-owned Contractor-operated Facilities</u></p>	<p>HNF-PRO-066, Electrical Utilities</p> <p>Lock & Tag Program</p> <p>HNF-PRO-074, Safety Responsibilities</p> <p>HNF-PRO-076, Safety Inspections</p> <p>HNF-PRO-079, Job Hazard Analysis</p> <p>HNF-PRO-081, Hazardous Energy Control Program</p> <p>HNF-PRO-085, Hand and Portable Power Tools</p> <p>HNF-PRO-088, Electrical Work Safety</p> <p>HNF-PRO-083, Personal Protection</p> <p>HNF-PRO-091, Walking/Working Surfaces</p> <p>HNF-PRO-092, Fall Protection</p> <p>HNF-PRO-093, Elevating Work Platforms</p> <p>HNF-PRO-094, Portable Ladders</p> <p>HNF-PRO-095, Scaffolding</p> <p>HNF-PRO-096, Material Handling and Storage</p> <p>HNF-PRO-110, Confined Space</p>	<p>PHMC Policies and Procedures provide the controls to assure personnel occupational safety. Additional facility-specific procedures are FSP-FSS-5-35, Section 09-01, FSS Lock and Tag Procedure, and Section 02-01, FSS Job Control System.</p>

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT	DOE ORDER/TITLE	APPLICABLE PROJECT HANFORD PROCEDURES	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES
Fire Protection	5480.7, <u>Fire Protection</u>	<p>HNF-PRO-340, Fire Protection Program Overview & Responsibilities</p> <p>HNF-PRO-350, Fire Hazards Analysis Requirements</p> <p>HNF-PRO-351, System Testing/Inspecting and Maintenance Frequencies</p> <p>HNF-PRO-360, Fire Protection/Prevention for Construction, General Occupancy and Demolition Activities</p> <p>HNF-PRO-684, Fire Protection Facility Assessments</p>	<p>PHMC Policies and Procedures provide the controls to assure fire protection. Facility-specific Pre-fire Plans have been established and are maintained to aid the Hanford Fire Department. FSP-FSS-5-35, Section 16-04, FSS Control of Storage Building Fuel and Combustible Materials Inventories, administratively limits the consequences of the maximum possible fire. FS-NOP-10-001, Independent Verification of Storage Building Fire Protection Systems, assures proper system configuration following maintenance activities.</p>
Industrial Hygiene	5480.10, <u>Contractor Industrial Hygiene Program</u>	<p>HNF-PRO-111, Occupational Medical Qualification & Monitoring</p> <p>HNF-PRO-115, Hearing Conservation</p> <p>HNF-PRO-119, Lead Protection</p> <p>HNF-PRO-121, Heat Stress Control</p> <p>HNF-PRO-120, Respiratory Protection</p> <p>HNF-PRO-408, Asbestos-Facility Management/General Industry</p> <p>HNF-PRO-584, Bloodborne Pathogens</p>	<p>PHMC Policies and Procedures provide the controls assure personnel occupational safety. FSP-FSS-5-35, Section 01-13, FSS Hazard Communication Control Program, addresses industrial hygiene issues.</p>
Criticality Safety	5480.24, <u>Nuclear Criticality Safety</u>	<p>HNF-PRO-334, Criticality Safety: General Requirements</p> <p>HNF-PRO-537, Criticality Safety Control of Fissionable Material</p>	<p>The PHMC Policies and Procedures provide the controls to assure criticality safety. Facility-specific controls are embodied in the FSS Criticality</p>

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT	DOE ORDER/TITLE	APPLICABLE PROJECT HANFORD PROCEDURES	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES
		<p>HNF-PRO-538, Criticality Safety Training</p> <p>HNF-PRO-539, Criticality Safety Evaluation</p> <p>HNF-PRO-540, Criticality Prevention Specifications</p> <p>HNF-PRO-541, Criticality Safety Postings</p> <p>HNF-PRO-542, Fissionable Material Labeling</p> <p>HNF-PRO-543, Fissionable Material Storage</p> <p>HNF-PRO-544, Criticality Plant Configuration Control</p> <p>HNF-PRO-545, Fissionable Material Packaging and Transportation</p> <p>HNF-PRO-547, Criticality Safety for Firefighting</p> <p>HNF-PRO-548, Criticality Safety Inspections and Assessments</p> <p>HNF-PRO-549, Criticality Safety Nonconformance Response</p>	<p>Prevention Specifications. A facility-specific Criticality Safety Representative has been designated and trained in accordance with HNF-PRO-538, Criticality Safety Training.</p>
Training	<p>5480.20, <u>Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities</u></p>	<p>HNF-PRO-059, Environmental Safety and Health Training</p> <p>HNF-PRO-065, Environmental Training</p> <p>HNF-PRO-071, Radiological Control Technician Training</p> <p>HNF-PRO-082, Radiological</p>	<p>The PHMC Policies and Procedures provide the controls to assure overall personnel training. Facility-specific procedure FSP-FSS-5-35, Section 05-02, Training Plan, provides for implementation of overall and specific training requirements. HNF-IP-1277,</p>

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT	DOE ORDER/TITLE	APPLICABLE PROJECT HANFORD PROCEDURES	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES
		<p>Worker Training</p> <p>HNF-PRO-166, Transportation Safety Training Requirements</p> <p>HNF-PRO-329, Radiological Training</p> <p>HNF-PRO-459, Environmental Training</p> <p>HNF-PRO-538, Criticality Safety Training</p>	<p>300 Area Radiological Control Procedures, defines the HPT training program for the River Corridor Project.</p>
Radioactive Waste Management	5820.2A, <u>Radioactive Waste Management</u>	<p>HNF-PRO-156, Nonradioactive Hazardous Materials/Hazardous Waste (HM/HW) Shipments</p> <p>HNF-PRO-157, Radioactive Material/Waste Shipments</p> <p>HNF-PRO-455, Solid Waste Management</p>	<p>PHMC Policies and Procedures provide the controls to assure acceptable waste management. Facility-specific controls that are established and implemented include FSP-FSS-5-35, Section 01-06, Administrative Controls for Waste, and waste-stream specific Waste Certification Summaries.</p> <p>WHC-EP-0063, Hanford Site Solid Waste Acceptance Criteria, guide waste characterization, segregation, and packaging activities.</p>
Occurrence Reporting	5000.3B, <u>Occurrence Reporting and Processing of Operations Information</u>	HNF-PRO-060, Reporting Occurrences and Processing Operations Information	<p>PHMC Policies and Procedures provide the overall controls to assure acceptable occurrence reporting. A facility-specific procedure, FSP-FSS-5-35, Section 06-02, Occurrence Categorization, Notification and Reporting, has been established and implemented.</p>

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT Quality Assurance	DOE ORDER/TITLE <u>414.1 Quality Assurance</u> <u>10 CFR 830.120, Quality Assurance Program</u>	APPLICABLE PROJECT HANFORD PROCEDURES HNF-MP-599, Project Hanford Quality Assurance Program Description HNF-PRO-052, Corrective Action Management HNF-PRO-222, Quality Assurance Records Standards HNF-PRO-224, Document Control Program Standards HNF-PRO-233, Review and Approval of Documents HNF-PRO-246, Management Assessment HNF-PRO-261, Quality Assurance Program Plan HNF-PRO-268, Control of Purchased Items and Services HNF-PRO-298, Nonconforming Item Reporting and Control HNF-PRO-301, Control of Suspect/Counterfeit Items HNF-PRO-653, Deficiency Tracking System	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES PHMC Policies and Procedures provide the controls to assure acceptable QA. Facility-specific procedure, FSP-FSS-5-35, Section 01-03 Records, and Section 01-16, Management Self Assessment, provide for essential record retention and ongoing self assessments, respectively FSS-specific Quality Assurance Program Plan (QAPP) is HNF-2330.
Configuration Management	<u>4330.4B, Maintenance Management Program</u> <u>5480.21, Unreviewed Safety Questions</u> <u>5480.22, Technical Safety</u>	HNF-PRO-544, Criticality Plant Configuration, Control HNF-PRO-233, Review and Approval of Documents HNF-PRO-062, Identifying and Resolving Unreviewed Safety Questions	PHMC Policies and Procedures provide the overall controls to assure acceptable configuration management. Established facility-specific controls include FSP-FSS-5-35, Section 02-01, Job Control System, FSP-FSS-5-35, Section 01-11, Unreviewed Safety Questions, and the

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT	DOE ORDER/TITLE	APPLICABLE PROJECT HANFORD PROCEDURES	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES
	<u>Requirements</u> 5480.23, <u>Nuclear Safety Analysis Reports</u>	HNF-PRO-704, Hazard and Accident Analysis Process HNF-PRO-440, Engineering Document Change Control Requirements	Interim OSRs (Besser 1998). FSP-FSS-IP-1155 defines the maintenance program for FSS, which includes configuration control.
Conduct of Operations	5480.19, Conduct of Operations Requirements for DOE Facilities	HNF-PRO-246, Management Assessment HNF-PRO-060, Reporting Occurrences and Processing Operations Information	A facility-specific graded approach to conduct of operations has been developed and approved by DOE-RL, and is being implemented: Correspondence No. FDH-9954010A R1, "Approval of the Fuel Supply Shutdown Project Revised Conduct of Operations Applicability Matrix, June 16, 1999.
Emergency Planning	5500.2B, <u>Emergency Categories, Classes, and Notification and Reporting Requirements</u> 5500.3A, <u>Planning and Preparedness for Operational Emergencies</u> 4330.4B, <u>Maintenance Management Program</u>	HNF-PRO-60, Reporting Occurrences and Processing Operations Information HNF-PRO-453, Spill and Release Reporting HNF-PRO-424, Emergency Preparedness Program HNF-PRO-069, Maintenance Management HNF-PRO-472, Cold Weather Protection	The PHMC Policies and Procedures provide the overall controls to assure acceptable emergency planning. The facility-specific emergency plan that has been established and is being implemented is HNF-IP-0263-333, Building Emergency Plan for Fuel Supply Facilities.
Maintenance			FSP-FSS-5-35, Section 02-01, Job Control System, provides controls to perform maintenance. Also, FSP-FSS-IP-1155 defines the maintenance program for FSS.

INSTITUTIONAL CONTROL OR SAFETY REQUIREMENT	DOE ORDER/TITLE	APPLICABLE PROJECT HANFORD PROCEDURES	FUEL SUPPLY SHUTDOWN FACILITY-SPECIFIC PROCEDURES
Environmental Protection	<p>5400.1, <u>General Environmental Protection Program</u></p> <p>5400.5, <u>Radiation Protection of the Public and the Environment</u></p> <p>5480.4, <u>Environmental Protection, Safety, and Health Protection Standards</u></p> <p>5484.1, <u>Environmental Protection, Safety, and Health Protection Information Reporting Requirements</u></p>	<p>HNF-PRO-453, Spill and Release Reporting</p> <p>HNF-PRO-331, Workplace Air Monitoring</p> <p>HNF-PRO-455, Solid Waste Management</p> <p>HNF-PRO-462, Pollution Prevention</p> <p>HNF-PRO-3152, Polychlorinated Biphenyl Management</p>	<p>PHMC Policies and Procedures provide the to assure acceptable environmental protection. The facility-specific Facility Effluent Monitoring Plan (FEMP) has been reevaluated and a FEMP is no longer required. Based on the new FEMP determination, the facility does not require environmental monitoring.</p>

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